EL and P

JULY 1, 1960

NEWS IN PERSPECTIVE

ECONOMIC CLIMATE

BUSINESS UNCERTAINTY, becoming more widespread as the current high-level of economic dullness persists, is likely to be resolved by an upsurge in the fourth quarter. An important element making for a brightening outlook is the state of the metals inventories. They are close to bottom, and plant vacations in the summer months will probably lead to a further drawdown. Thereafter, the rate of decline will diminish. Prospects of a steel price increase in December (when wages will rise) probably will prompt some anticipatory buying. Price outlook for other metals shows steadiness for aluminum, weakness for copper, and a slightly rising tendency for zinc and lead.

INVENTORY RATE probably will persist as a mildly unsettling factor in coming months. The year's first quarter saw a high rate of buildup; it has since declined by about two-thirds. Seasonal influences will help show the accumulation of stocks even further in the current quarter, as business operates close to a hand-to-mouth basis. In the final period, inventories should once more rise—but only to an annual rate of $4 billion or so. If consumer buying intentions are a reliable indicator, another spate of inventory growth will be inescapable.

MANAGEMENT VIEW

"OUR INDUSTRY IMAGE is more directly the responsibility of NAEC, ECAP and PIP than it is for EEI, the Institute's newly-elected Pres. Sherman R. Knapp noted in his acceptance remarks . . . but EEI cannot avoid playing an important part in this field." He added: "Many utility people feel we would be in a better position if EEI, NAEC, ECAP and PIP were merged into one organization. Based on our experience (actively participating in the work of each), I feel the present setup gives us more flexibility and more inspiration to progressive activity than would be the case with only one organization."

THE GREATEST THREAT to our industry, declared the new EEI President in his "prospectus" remarks, "continues to be subsidized competition from governmental power undertakings . . . and the major handicap in meeting this threat is tax inequality." (See p. 31 for more samples of the industry speaking out against "the threat.") Pres. Knapp listed his own tasks as EEI chief this way: (1) to stimulate our own internal housekeeping, and (2) to find ways and means of making a favorable imprint on the minds of a largely disinterested and apathetic public.

BEST IDEAS FROM OTHERS have made Duke Power Company's "home-grown" management development program "something unique and successful beyond what you could possibly have anticipated," says a Georgia Institute of Technology economics and industrial management professor. When 36 participants completed their training recently (33 others have started in a new group), Duke's Pres. W. B. McGuire remarked: "Many firms have management development programs, but we feel that ours is unusual in that the curriculum was established to meet our own specific objectives without the use of an outside management development organization."

BUILD NEW PLANTS, OR ADD to existing plants? There's a great difference in favor of the latter, the Wisconsin P. S. Corp. tells the public, in explaining its decision to expand at its present location in Green Bay. Comparing a new plant start with the money that can be saved by adding to an existing plant "has given us no alternative, at this time, but to make another addition to our Green Bay plant," the utility's president, Harold P. Taylor stated. The utility's estimate of the proposed addition: $20-million; and the comparable cost of equivalent new capacity at a new location: $4-million more. (Meanwhile, though, Wisconsin P. S. Corp. has purchased land in two new locations, "for conceivable use in years to come.")

"OUR CUSTOMERS LEAD THE LIST (of residential customers usage on investor-owned electric power systems) with an average usage of 10,231-kwh a year, almost 3½-times the national average; yet, our residential customers pay about half the average rate paid by most American families for electric power," So. Nevada Power Co.'s Pres. Reid Gardner was able to tell his stockholders in their annual meeting June 1. (Odds are with the Las Vegas Utility in its expansion optimism, too. Of a $36.5-million investment in plant and equipment, $30.4-million has been made since 1954.)

WASHINGTON INFLUENCE

ENERGY RESOURCES INQUIRY is being made by the Joint Economic Committee's Subcommittee on Automation and Energy Resources. Chairman Patman (D., Tex.) has asked the heads of a number of federal agencies, state commissions, and other bodies concerned with production, distribution, or development of U. S. energy resources to outline and comment on its activities. The express focus of the inquiry is to "uncover and study the variety and extent of the present complex of relationships between owners, producers, distributors, and the several levels and instrumentalities of government." Statements are to be filed no later than Sept. 15.

FRYINGPAN-ARKANSAS PROJECT has been dropped by Congress this year, but Rep. Aspinall (D., Colo.) hopes that the record made this year will facilitate floor action early in 1961. L. R. Patterson, vice-president, Electric Operations, Public Service Co. of Colorado, renewed the offers of his firm and of Southern Colorado Power Co. to wheel power from the project when it is built. He asked that no funds be granted to the Reclamation Bureau for building transmission lines "provided that suitable wheeling or similar contractual arrangements can be negotiated" with the companies.

FPC REVISED SYSTEM of accounts, applying to electric utilities of Classes A and B and to holders of FPC licenses for hydro projects, becomes effective next January 1.

NO FEDERAL LIABILITY, says the Supreme Court, for state loss of water rights in the Federal construction of Fort Gibson Dam. The Grand River Dam Authority of Oklahoma had won a decision in the Claims Court, but the Department of Justice appealed to the Supreme Court. The lower court had upheld state claims for water power rights, including the right to develop electric energy, but did not set an amount.

SEC-ORDERED SALE by a public utility of a subsidiary's stock is not an involuntary conversion. The U. S. Court of Claims has held that an ordinary loss for tax purposes does not result from such a sale, even though it was directed by the Securities and Exchange Commission under the Public Utility Holding Company Act.

ANTI-ECAP BILL, introduced by Rep. Moulder (D., Mo.), has been modified by its sponsor. Revision of the measure, which is given no chance of enactment this year, adds language that specifically denied tax deduction to advertising "which is designed to influence political opinion or election of public officials or to influence the action or decision of any federal, state, or local government."

PRDC SAFETY FINDINGS by AEC have been called "insufficient" by the U. S. Court of Appeals for the District of Columbia. In a 2 to 1 decision, the Court ordered AEC to take another look at the Logoona Beach, Mich., site—30 miles from Detroit—to be sure that the $45-million A-power plant could be operated without undue public risk. AEC has asked that the full (nine-member) Court review the case.

NEW AREA DEVELOPMENT TOOL of exemplary effectiveness is Cleveland Electric Illuminating's, "More Land for Industry," a comprehensive study of potential industrial land potential of 125,000-acres, will need 20,000 more by 1980 and at least 90,000 more in the next 100 years . . . but only 6000 of them are ready for industry right now. Industrial planning suggestions and development opportunities are outlined.

LOAD-CENTER UNIT SUBSTATIONS of the "highly-engineered, selectively coordinated" type have jumped proportionately to 30-percent of all General Electric substation shipments—an increase of 200-percent since GE eliminated a price premium last year. And, GE predicts that the trend in the low-voltage apparatus will continue, "primarily because of added engineering content of this equipment." (On high voltage equipment, GE also announced a price reduction on single-tank oil-filled power circuit breakers—to 7½-percent below comparably rated three-tank breakers. Here, market response preceded the price cut, with this type of breaker already accounting for more than half of GE sales of subtransmission voltage units.)

LOOKING AHEAD... FINANCIALLY

--From Irving Trust

1960 construction by principally electric utilities will total $3.8-billion, up a little from the 1959 total of $3.7-billion, according to estimates made up to June.

Financing for these same companies will amount to $1.8-billion this year, down somewhat from the $1.9-billion completed in 1959. (This represents reports from most of the companies and can be considered reasonably complete.)

Principally gas utilities plan $1.5-billion of construction this year, about the same as the 1959 total.

For the first half of 1960, electric financing will total $874-million: $694-million of bonds, $76-million of preferred, and $104-million of common. Gas financing will total $424-million: $284-million of bonds, $42-million of preferred, and $98-million of common. Therefore, approximately half of financing for 1960 will be done by the end of June.

Scheduling for third quarter financing is not yet completed, but up to this time electric utilities have scheduled $328-million and gas utilities $91-million, so far without serious conflict or congestion.

ARIZONA'S FIRST LARGE-SCALE coal-burning powerplant, a 110,000-kw station to be located in the northern part of the state near Joseph City, will get underway this month, aiming for completion in two years. Back of the project is a 35-year agreement for the plant's coal supply, with Pittsburg (Kans.) & Midway Coal Mining Co., according to the utility's Pres. Walter T. Lucking.

"BRING US MILLS TO MATCH OUR TREES" is the way research findings of the Central Louisiana Elect. Co. dramatize a utility-spotlighted situation where "an area has never been more ripe for area development." Modern reforestation and more than 5½-million acres of forest land point to a thriving pulpwood empire that has barely been tapped, concludes the recent CLECO study, noting that the pulpwood surplus could support six more 300-ton craft pulp mills now!

PROVINCIAL GOVERNMENT POWER grew larger by $7.5-million worth of electrical system property last month, when the Saskatchewan Government acquired the National Light & Power Co. facilities at Moose Jaw. The third largest city in the Canadian province held an option to buy this subsidiary of Iowa Southern Utilities Co., but decided not to exercise it. When "the owners were prepared to sell in any case," the Provincial Power Corp. stepped in.

THOUGHT AND ACTION LEADERS in large metropolitan areas can now work with "a nucleus of GE's most knowledgeable transportation people," with the establishment of a new GE metropolitan transportation development function. GE's V-P Fred J. Borch called upon such leaders "to spearhead a public education program to alleviate the mounting problem of metropolitan Traffic."

UPPER COLORADO TRANSMISSION system, proposed by Interior, has been questioned by Sen. Moss (D., Utah). Moss wants to know why a line northward from Glen Canyon into Utah--needed, he says, to serve many preference customers--was not included in Interior Dept. revision.

VAST RESOURCE DEVELOPMENT, on a nation-wide scale, has been urged by the Democratic Advisory Council's 28-man resource group, which is drawing up campaign planks.

INDUSTRY SIFTINGS

BEST ANNUAL REPORT among the outstanding reports of 22 electric companies honored in the 21st annual Reddy Kilowatt, Inc. competition was Florida P. & L. Co's. First awards in specific classes (depending on size and class of company) went to: Philadelphia Elect. Co., No. Indiana P. S. Co., Arizona P. S. Co., Iowa Southern Utilities Co., American Elect. Pwr. Co. and Nova Scotia L. & P. Co., Ltd. Presentations of the awards were made at the recent EEI annual convention.

THERMOELECTRIC-THERMIONIC generator, the first combination of two such advanced forms of direct conversion, is being operated experimentally inside a nuclear reactor by Westinghouse. Not a "breakthrough," says Scientist John Simpson, yet it is giving us a "toe-hold" to expand and explore the possibilities for application--probably in space vehicle operation . . . possibly for central station purposes in the long-range.

RATE OF RETURN OF 6.35% was allowed the P. S. of Colorado in recently awarding the utility a gas and electric rate increase that will permit the company to earn additionally about $4,400,000 in gross annual revenues . . . In Ohio, after ruling that current cost of money and not historical cost of capital must be used in determining the fair return to a utility, the Ohio Commission said this case (the Ohio Fuel Gas Company) would be taken to the U. S. Supreme Court.

ANTITRUST TRIALS stemming from Grand Jury indictments are expected by the Justice Department to start in the fall. First cases to be tried will involve alleged switchgear pricing malpractice. Trials probably will not begin until some changes have been made in the language of indictments, particularly in regard to dates. Likely to be called as witnesses for the government are firms and individuals who have already entered pleas of guilty. (In mid-June, a plea of "guilty" was entered by Allis-Chalmers, while 12 other manufacturers pleaded "innocent.") Later, treble-damage suits are expected to be filed.

ATOMIC-INDUSTRY SALES amounted to about $1.5-billion in the period 1954-58, according to a study by the Atomic Industrial Forum ("Business Statistics on the Atomic Industry, 1954-1958," $3.50 a copy). More than 65-percent of the total is estimated to have been composed of components, equipments and materials for nuclear reactor systems; and more than 75-percent was accounted for by U. S. government contract and subcontract purchases.

"HOW CAN CUSTOMERS DEPEND on Westinghouse when Steam Division employes apparently can be pulled out on a strike or some kind of work stoppage easier than any other plant in the electrical industry?" Appealing to employes after the UE withdrew its strike authorization early last month and Local 107 agreed to discuss 51 grievances while employes work. Westinghouse Negotiator Wm. C. Rowland asked further: "Is this the reputation we want?" His letter to all plant employes cautioned: "Each and every employe has an important part to play in how successful our business will be. Our success will depend on what you think about the recent strike and what you do about it."

HAND-LEDGERS-TO-COMPUTERS is the span of only a handful of utility executives still active in the industry's accounting areas, but that's the era-to-era service record of a few like Pacific P. & L.'s retiring V-P Geo. F. MacKenzie. Controller MacKenzie, a 47-year veteran of the Portland-based utility, began when "a day's progress was set by men and horses"; today, of course, Pacific Power's customer accounting, inventories and stockholder records are computed and tabulated by lightning-fast electronic computers . . . and tasks that once took hours are now performed in split-seconds.

Spokesmen For Investor-Owned Electric Utilities

Step Up Offensive, with Goal of Equating Industry's Image—U. S. Economic System

This election year, if anything, is sharpening the attack of "investor-owned, business-managed" electric power interests against the threat of government encroachment.

Focal point for industry expression is, of course, the EEI annual meeting . . . and this year, leading spokesmen pulled no punches in their expressions of concern and intentions to stay on the offensive. (This contrasted with the "defensive" statements of years past, as noted in a recent message by Ash Collins reported briefly on page 54.)

The greatest threat to our industry continues to be subsidized competition from governmental power undertakings and the major handicap in meeting this threat is tax inequality. Singling out this target, EEI's newly-elected Pres. Sherman R. Knapp promised:

"It is my hope that during the coming year substantial progress can be made in correcting this situation and I intend to make this a primary objective during my term of office."

Mr. Knapp explained the investor-owned electric utility industry's position this way:

"We have no quarrel with the idea that the electric bill is a reasonable and convenient device for collecting taxes to support local, state and Federal government. We justifiably contend, however, that everyone who pays an electric bill should make a proportionate contribution to the support of government."

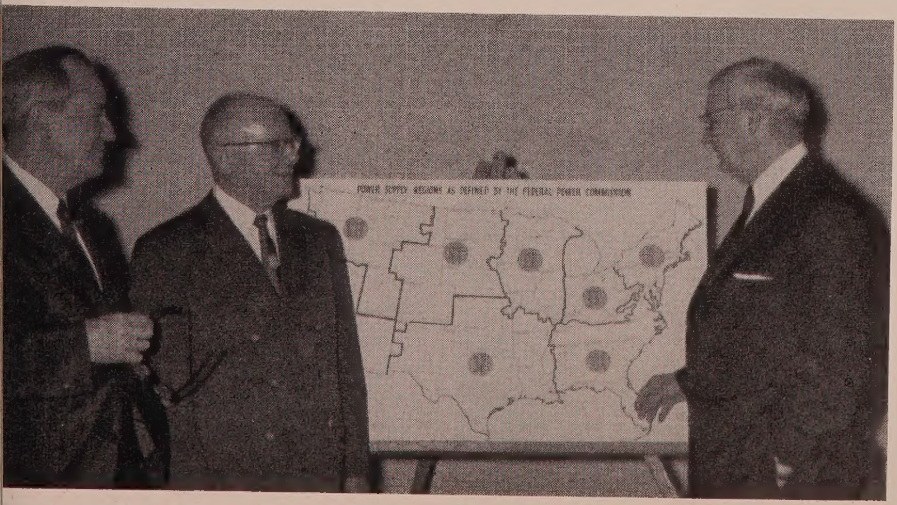
Mr. Knapp added a recommendation to electric utility companies concerning "responsibility for our industry image." Referring to NAEC, ECAP and PIP, he said, "I hope you take advantage of the help that our national industry groups can be in this direction. And, he pointed out, "EEI cannot avoid playing an important part here.

"It is regrettable in the eyes of many in our industry that we are not so constituted that we can have an industry spokesman who could promptly and effectively answer attacks on us from those whose objective is the nationalization of the electric power business. The Edison Electric Institute, however, is in a position to set the record straight when reckless and misleading statements are made about us and I believe we should not be timid in speaking out when such a course is indicated."

Retiring Pres. Allen S. King reiterated his "Main Street" approach, emphasizing the need for such an effort with these comments:

"If we are to insure the continuation of the free enterprise climate that has made possible the rapid growth of the American electric industry, electric companies throughout the country must redouble their efforts in this area of economic education. Freedom can be, and has been, lost through neglect. A free economic system can be replaced by a totalitarian system if the people do not want it and do not work to keep it.

"The future of the electric industry and of the nation as a whole depends on a continuation of the American free economic system, and in maintaining the electric util-


POWER SUPPLY REGIONS AS DEFINED BY THE FEDERAL POWER COMMISSION

st defense—why, a good offense, of course! And, that's just what EEI spokesmen shaped up recent weeks in the form of industry forecasts demonstrating ability to serve the nation with ctric power. (See EL&P, May 15, p. 47.) Shown presenting facts from the 20-year look-ahead to press are (l. to r.): EEI Managing Director Ed. Vennard, Allen S. King and C. E. Oakes.

ity business as an integral part of that free enterprise system.

"There are some people who say that the job of supplying electricity to the country in the future is too big for industry so that the government must do it. I say to you that the job is so big that free enterprising industry must continue to do it, not government."

The new EEI president, Connecticut L. & P.'s Pres. Sherman R. Knapp, has used numerous occasions in the past year to hit hard at this theme. For example, in addressing a recent press conference called by the three electric utility companies which supply 90-percent of Connecticut's power needs, he stated:

"We, the investor-owned electric companies in America and New England, are vitally concerned over increasing pressures which would put government in the power business right at our doorstep."

New warnings against "dependency on government" and the invasion of "forces of government in business" were given to stockholders of more than a few private power companies across the nation in annual meetings this Spring.

In Topeka, Kansas, for example, shareholders of the Kansas Power & Light Co. heard a review of the company's operations during the 50's—a period in which the utility completed 10 years as an independent publicly-owned organization without holding company affiliations. Predicting "a bright outlook for the future," Chairman D. E. Ackers observed:

The motto of a utility must be "eternal vigilance"—vigilance against the forces of government in business. You as stockholders can assist us in combating such adverse influences.

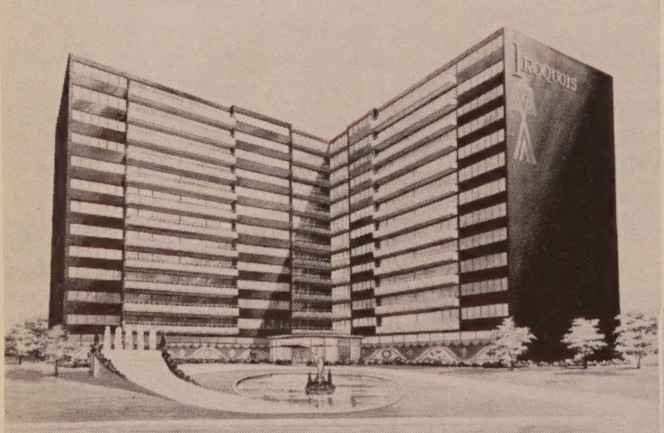
Stockholders of Southern California Edison Company were urged by Chairman Harold Quinton to play a more active role in politics in order to end the "deadening apathy that has overtaken us in acceptance of an ever-growing domination by government over every facet of our lives."

Mr. Quinton said it is the utility's policy to encourage its employees not only to vote, but also to take part in selecting political candidates and give financial support to the political party of their choice.

"The responsibilities of citizenship in this greatest of all world democracies calls, of course, for active citizen participation at the polling place, but also calls for participation in grass roots community and political party organizations of the citizen's choice, where the selections and campaign plans and plans for financial support of candidates for political office begin.

"It is becoming apparent that the nation's most serious problem, and the underlying cause of most of its other problems, is the "continuing demoralization and resulting complacency and apathy of the American people, which has grown out of their dependency on government," Mr. Quinton concluded.

U. S. IS BUILDING . . . ALL-ELECTRIC!



Largest all-electric apartment house in the U. S., the "Iroquois," will be a 13-story, $3.5-million building for luxury living in Philadelphia. GE will supply all appliances for the 132-unit project, with groundbreaking set for this month.

Largest *all-electric* community development to be undertaken within commuting distance of NYC was launched recently as a joint project of the W. J. Happel development firm, General Electric and Jersey Central P. & L. Co. Shown at announcement event are GE's Geo. T. Bogard and Jersey Central's Pres. Chas. E. Kohlhepp. "Electric City, U. S. A." will include 6000 Gold Medallion private homes, 5000 apartment units.

Pressure of Financing "Acute," Says ConEdison

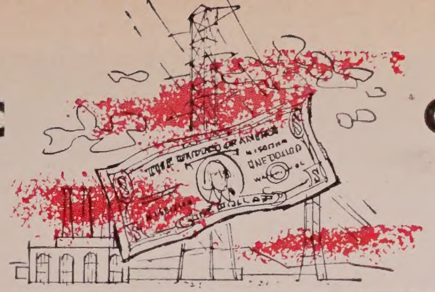
Shareholders of the Consolidated Edison Co., in their recent annual meeting, heard some strong terms used to describe the utility's immediate future expansion plans. Board Chairman H. C. Forbes referred to generating capacity additions underway as "truly immense" and called the pressure of financing "acute." He said:

"As of today we have, either in process of installation in our stations, or in process of fabrication in various manufacturers' plants, a total of nearly 1,750,000 kilowatts of new capacity. This is equal to one-third of our present system capacity.

"This new capacity to be added to our system is nearly *twice the capacity of the hydro-electric station* on the *American side of the St. Lawrence development at Massena.* It is about the equivalent of the total generating capacity that exists in the states of Main, New Hampshire and Vermont.

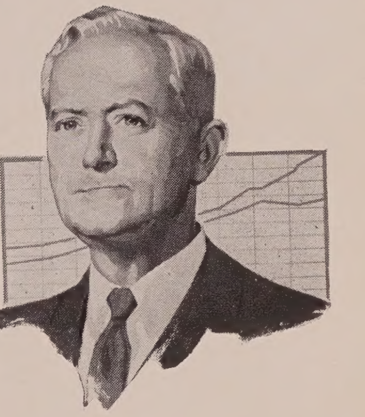
"The pressure of financing is acute. We shall have to do more financing in the fall, and we are anxious to be in a position by that time to call our presently outstanding issue of 4-percent debentures, thereby bringing about their conversion into common stock. If we can get the debentures converted we shall probably issue rights to the common stockholders to subscribe to additional equity securities, *either* convertible debentures or common stock, as may seem best at the time," advised Mr. Forbes.

ECONOMIC OUTLOOK



by A. C. FARMER
Economic Consultant

The Problem of Employment



With the passage by Congress of the Employment ct of 1946, the problem of employment became a olitical as well as an economic problem. The subject as been discussed in previous issues (July 15, 1958 nd October 1, 1959), and is brought up to date in he table*, which shows changes in the period 1957 o 1959.

For the ten years under review, the employment n the productive groups has shown a slight decrease, n spite of a steady expansion in the output of goods, s measured by the Federal Reserve Index of Industrial Production.

On the other hand, there has been a steady increase n the number of people employed in those activities isted under the service groups.

The explanation is to be found in the fact that ncreased mechanization has made possible in the roductive Groups a vast increase in production per an-hour, while in the Service Groups, mechanizaion, even considering the enormous labor-saving ade possible by computers, has been much less ffective in increasing productivity.

The following conclusions reached two years ago till apply to the present situation:

1. For many years a numerical increase in the number of workers in the Productive Groups should not be anticipated.
2. Technological improvements continuously will be made in the methods employed in the Productive Groups, and, in consequence, in these groups there will be greater and greater demand for technically trained workers.
3. Technically trained workers will be higher-paid workers, and this should foreshadow fewer labor disturbances and therefore greater economic stability.
4. For many years increased employment must be absorbed in the Service Groups, which in the future will exceed numerically the employment in the Productive Groups.

At this time in the field of economics these facts do not seem fully to be appreciated, but it is noticeable that labor is endeavoring to gain acceptance of a standard work week of less than forty hours. So far these efforts have not been successful.

The overall effects of mechanization on employment will increase as continuous research in this particular field brings results that are more and more successful.

TWO-YEAR CHANGE IN EMPLOYMENT

	December 1957	December 1959	Change
	Dollars in Millions		
Population	172.51	179.02	+ 6.51
Total Labor Force	70.46	71.81	+ 1.35
Armed Forces	2.69	2.53	— 0.16
Civilian Labor Force	67.77	69.28	+ 1.51
Unemployed	3.37	3.58	+ 0.21
Employment in Productive Groups			
Manufacturing	16.30	16.48	+ 0.18
Durable	9.43	9.57	+ 0.14
Non-Durable	6.87	6.91	+ 0.04
Mining	0.79	0.67	— 0.12
Contract Construction	2.61	2.70	+ 0.09
Transportation and Public Utilities	4.10	3.94	— 0.16
Agriculture	5.39	4.81	— 0.58
Total	29.19	28.60	— 0.59
Employment in Service Groups			
Wholesale and Retail	12.08	12.35	+ 0.27
Service and Miscellaneous	6.32	6.55	+ 0.23
Finance — Insurance — Real Estate	2.35	2.44	+ 0.09
Government	8.07	8.64	+ 0.57
Total	28.82	29.98	+ 1.16

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* In the table, employment in manufacturing, mining, construction, ansportation, public utilities, and agriculture is included under the eading "Protective Groups," while employment in wholesale and etail trade, service and miscellaneous, finance, insurance, and real state, and government is included under the heading "Service roups."

It is startling to realize that outside of the classified Production and rvice Groups, there is a large area, including some 9-million people, hose status as employed, part-time employed, or unemployed, is in nsiderable doubt in the field of statistical analysis. The statements ade so confidently on the total amount of unemployment necessarily e highly inaccurate.

Only a system requiring that an identification card be filled out for ery individual from which periodic reports could be made and llected, could clarify the records of employment and unemployment.

Photo by Riehle Studios

Minnesota's Capital City

St. Paul, capital city of Minnesota, is prominent, too, for its widely diversified industries. These include brewing, food processing, livestock marketing, manufacturing, oil refining and printing. The city's transportation needs are served by nine different railroads, totalling one quarter of the nation's rail mileage.

The combination of demands for electric power is expected to nearly quadruple power needs of the area within 20 years. This requirement, together with the future needs of railroads and all industry, is being anticipated by Kerite, with a standard of cable dependability established in 1854. *As the need for quality cable continues to grow, Kerite will be ready to supply it.*

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WASHINGTON OUTLOOK

by RALPH ELLIOTT

Washington Editor

A Victim Of Politics

Thanks largely to the ways of olitics, the Federal Power Comnission is in a pretty sorry state. Commission and staff are undernanned, overworked, and are operating in an atmosphere of dangerously rundown morale. What's nore, the situation promises to get vorse before it gets any better.

No clear-cut or completely faultess analysis of the how and why of the situation can be made. Nor s it possible even to approach any lefendably accurate apportionment of blame among various quarters. The reason is that, typically in cases vhere political considerations dominate, the background includes a number of murky areas and beneath-the-surface involvements hat can't be nailed down for appraisal purposes.

The facts that are available, however, strongly indicate that most of he blame rests with the Adminstration.

As things stood at this writing, he unreapppointed Commissioner Connole was packing his belongngs, having said he would leave office at the end of his term on June 22 regardless of the outcome of pending legislation which would permit him to remain on FPC pendng the appointment and qualificaion of a successor. The only explanations from the White House s to why Comm. Connole was dumped had been either ineptly curt or poorly timed.

It had become apparent that the Democratic leadership in control of hings on Capitol Hill had no intenion of taking confirmation action on the President's nominations to FPC—Thomas J. Donegan to replace Comm. Connole, and Paul A. Sweeney to fill out the remaining hree years of the term of the late John Hussey. Congressional Republicans significantly were making no serious effort to get confirmation action, and for a good reason: the President had played too far into the Democrats' hands.

There seems to be no doubt that had Comm. Connole been reappointed and any qualified Democrat named to fill out the term of Comm. Hussey, both nominations would have been confirmed and a lot of grief avoided. But, so the story goes, howls went up to the White House early this year from powerful gas producer interests that Connole was too "consumer minded" to be impartial. Ditch Comm. Connole, the complainers reportedly urged, but if it isn't politically feasible to do so then he must be counterbalanced with another man from a major gas producing state. (Mr. Hussey and his predecessor, the late Seaborn Digby, were both from Louisiana and were identified as representing the producer viewpoint).

Somewhere along the line the decision was made, according to the President, that "the purposes of these (regulatory) agencies would best be served if nominees to those bodies did not become identified as representing any point of view narrower than the broad public interest." If the nominations of Messrs. Donegan and Sweeney were in fact made on the basis of such decision, it seems strange indeed that it did not come to light until about two weeks after the nominations had reached the Senate and the controversy over setting Comm. Connole adrift had boiled to the name-calling stage.

But regardless of what impelled the President in his choice for the FPC posts, the whole affair couldn't have been handled much worse. First, there was the White House failure to make any public statement to clarify Mr. Connole's status during the long period when the "leak" was being publicized that the Commissioner was through.

Then Mr. Eisenhower hooked badly into the rough when, finally admitting to the press that he wouldn't renominate Mr. Connole, curtly waived the matter aside by saying he could find "a better man." With the next shot—the naming of Mr. Donegan—Ike sliced into an unplayable lie. (No reflection on Mr. Donegan. His record as a public servant is a good one, but contains nothing that specially qualifies him for FPC service.) It's no wonder that the Democrats in effect have told the President he might as well put his ball in his pocket.

The whole affair has handed the Democrats not only a campaign issue, but also some leaverage that could lead to a political realignment of FPC next year. In the particular atmosphere created by White House ineptness, it will not be difficult or politically inexpedient to pigeonhole both nominations—even though Sweeney is well qualified. If, having road-blocked the nominations, they should elect a president in November, the Democrats would be in a position to have majority representation on the Commission by filling the two existing vacancies and replacing Arthur Kline when his term expires next June.

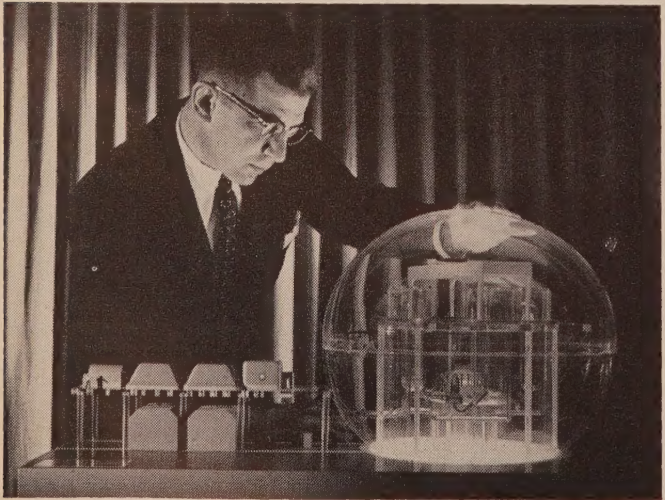
This is all good, clean, political fun. But where does it leave the FPC? Between June 22 and such time as the President might make interim appointments following the adjournment of Congress, the Commission will be a 3-man outfit—all Republicans. Maybe this isn't so bad, a lot of people could argue, but certainly it runs counter to the regulatory scheme established by law. Moreover, the stigma that would attach to any important opinions rendered during such period is too obvious to dwell on.

NUCLEAR NEWS

NO DIFFICULTY ANTICIPATED is the way a Yankee Atomic Electric official referred to the Corporation's expectation of AEC response to its recent preliminary request for an operating license. Said C. L. Derrick (vice-president for engineering of the Hartford Elect. Co.): "Since the inception of the project, the administrators, developers and engineers of Yankee have meticulously adhered to every rule and regulation of the Commission and its advisory committees and to date have a clear record at every step along the regulatory path." He added: "Neither do we intend to convey undue criticism of the elaborate and confining rules, regulations and safeguards established by the AEC." (Yankee proposed to follow low power testing with a program of successive stages of operation, each not to exceed 30,000-kwe, bringing the 110,000-kwe reactor to an operating level of 392,000-kw thermal for at least 500 hours of test operation.)

DEVELOPMENTAL IN NATURE—Dresden operation, though licensed at full power, must be so considered for some time to come, says the AEC's Reactor Safeguards Committee. Reason, according to the ACRS: "The large size of the reactor and the relatively novel aspects of some of its control features go considerably beyond prior experience with boiling water reactors."

CONSUMERS POWER REACTOR, now licensed for construction, will be operated at "acceptable power densities," if research and development does not indicate the feasibility of operating at power densities of up to 60-kw per liter (in limited core regions)—one of the major objectives of the project.



Model of 360,000-kw atomic power station is representative of the type which So. Cal. Edison proposes to build. Largest yet considered, it would operate with a Westinghouse reactor using uranium oxide fuel elements. Bechtel would also be part of the design-construction team.

DIVISION OF COMPLIANCE of the AEC is to take over responsibility for the Commission's program of license inspection from the AEC's Division of Inspection "on a step-by-step basis," under newly appointed Director Lawrence D. Low.

PROTOTYPE GAS-COOLED REACTOR under construction at Oak Ridge for nearly a year, is to be operated for the AEC by TVA. Essentially a test facility the project is to generate about 25,000-kwe for the Commission's Oak Ridge operations some time after a startup late in 1962.

NUCLEAR UTILITY SERVICES, INC., was formed recently to help electric utility companies plan and operate nuclear powerplants. Principal officers of the firm are Frederick H. Warren, board chairman; John E. Gray, president, and Dr. Warren F. Witzig, vice-president and technical director. L. H. Roddis, Jr. president of Penn. Elect. Co., is a director. Among services offered: counsel on choice of fuels, selection of sites, choice of powerplant designers, and contractors.

ATOMIC ENERGY SITE SURVEY will be made for the State of N. Y. by Vitro Engineering Corp., a step in the state's program to attract and accommodate a privately-sponsored reprocessing plant to augment present facilities in AEC installations.

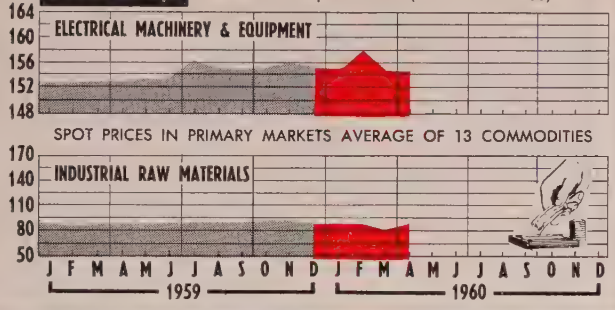
NEW CONTRACTS, ORDERS—Parr, S. C. Project of *Carolinas Virginia Nuclear Power Associates, Inc.* is to be built by the *Daniel Construction Co.* of Greenville, S. C.; *Research Reactor Building for the Ames (Iowa) Laboratory* will be designed for the AEC by *Burns & Roe; GE's Atomic Power Equip. Dept.* will furnish for the AEC's *Engineering Test Reactor* in Idaho 540 plate-type fuel elements and 126 control elements, supplementing an earlier order for 1,140 fuel elements and 272 control elements; for the *Enrico Fermi Plant, Datex Corp.* is supplying a logging system to provide a record of operation and warn of improper operation; and *Argonne National Laboratory* has placed its largest order for highly enriched uranium metal (1200-kilograms) with *Mallinckrodt Nuclear Corp.*

THERMONUCLEAR PLASMA PHYSICS will be the subject of a symposium, Aug. 22-26 in Gatlinburg, Tenn., sponsored by ORNL, ORINS, and the AEC.

MARKETING GUIDEPOSTS

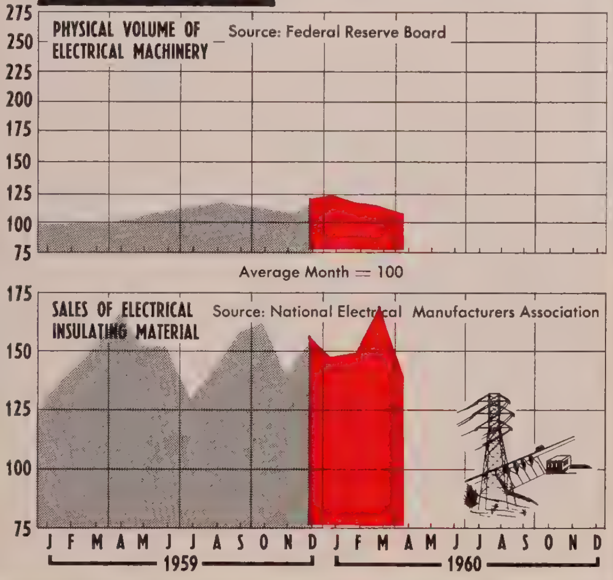
INDEX OF PRICES

Source: U. S. Dept. of Labor: (1947-1949 = 100)



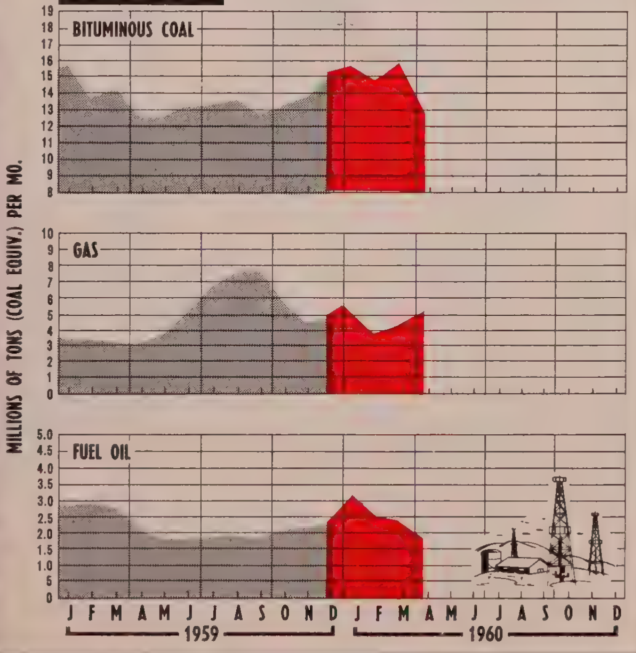
ELECTRICAL MANUFACTURING

Based on 1957

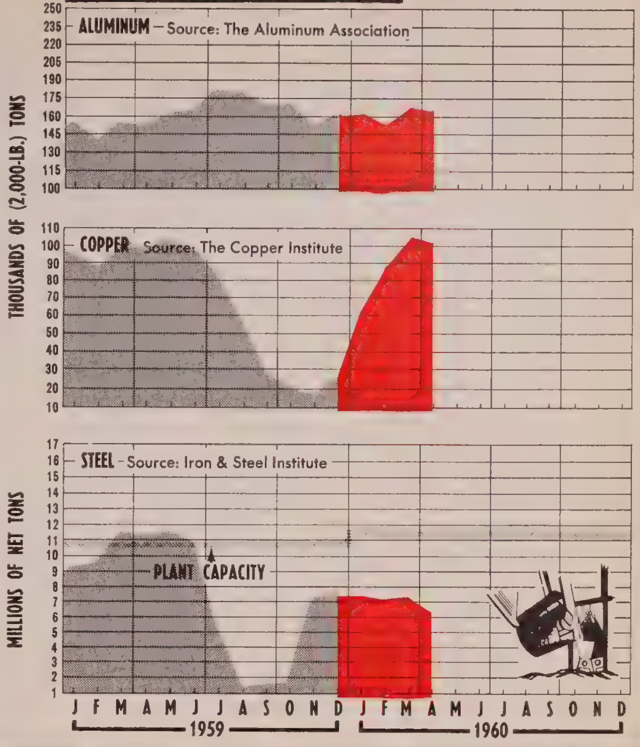


FUEL CONSUMPTION

ELECTRIC UTILITIES Source: Federal Power Commission

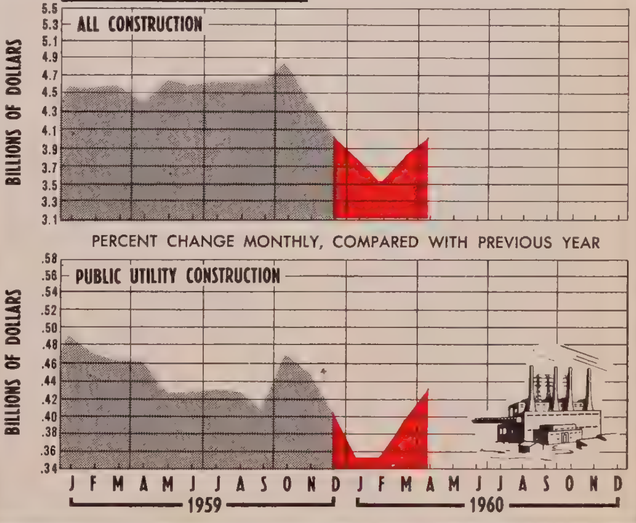


U. S. PRODUCTION OF PRIMARY METALS



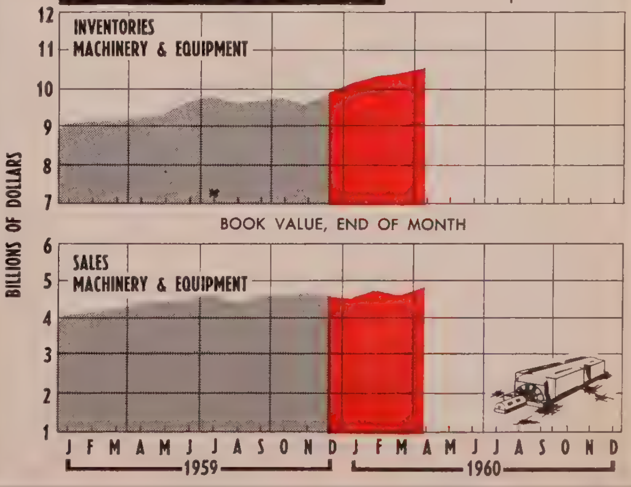
NEW CONSTRUCTION ACTIVITY

Source: U. S. Dept. of Commerce



MANUFACTURERS' INVENTORIES & SALES

Source: U. S. Dept. of Commerce



ENGINEERING/OPERATIONS

Melt Famous Ice Barrier

Refrigeration equipment used to freeze the gigantic underground ice wall which was used to hold back the groundwater from the high Gorge Dam excavation area in Seattle City Light territory, was turned off in May. Freezing had been maintained until grouting of the dam structure had progressed above the point where construction would be affected by the forming of a water pool on the dam's upstream side.

The ice barrier—when it extended across the entire river canyon—was 645-ft long, up to 260-ft deep and averaged over 25-ft thick. Freezing of the 310-ft section on the left bank was discontinued a year ago last month. At that time the gravity section was partially completed and the Skagit River was diverted and work started on the second stage construction.

Panels Reduce Transformer Noise

By use of sound absorbing panels, Westinghouse Electric Corp. obtained a noise level reduction for Utah Power and Light's 100-mva, 138- to 45-kv, McClelland Substation transformer, now located in Salt Lake City.

Thin metal panels were mounted on rubber blocks on all four sides of the unit at the Westinghouse transformer division in Sharon, Pa. Sound absorbing material was placed between the outside panels and the main tank. It is held in position by clips which are fastened to the main tank wall. The unit tested 54.8 db at the factory.

According to Westinghouse, one of the main advantages of supplying sound absorbing panels to the transformer vertical wall area is that a reduction of six to ten db can be realized at a relatively low cost, and it does not require any additional floor space. These panels can be applied to many units in the field without de-energizing the transformer for panel installation. All accessories remain attainable because the sound absorbing panels fit behind the radiators and around control cabinets and valves.

Denver Gets First Prefab Transformer Vault

Public Service of Colorado installed the first prefab transformer vault in Denver recently. The 42,000-lb concrete vault was installed in a record five days. On-the-spot construction would have taken 14 working days and another week for the concrete to set.

Measuring 20 ft 6 in. long, 6 ft 8 in. wide, and 9 ft 10 in. high, the post-stressed vault was positioned over an alley area where the paving had been previously removed. The floorless concrete framework gradually sank into the ground as the earth was removed from the area within its walls. As it descended into the excavation, the vault's walls served as casing to prevent the sides of the hole from caving in.

A concrete floor was poured and a prefab top installed when the vault reached the required depth.

Ships Largest Flexible Neutral Connector

Penn-Union Electric Corp. recently shipped this 10,000-amp flexible neutral connector to Allis-Chalmers Mfg. Co. It is the largest shipped from Penn-Union to date. It will connect the neutrals of a steam turbine generator capable of 282 mva at 20 kv. The connector is eight-ft long and weighs about 700 lb. It is made up of three six-in silver-plated copper-alloy stud connectors using 32 double-braid connectors for joining them.

AEP Tests Aluminum Transformer

This 25-kva aluminum transformer has been installed on a bank in Appalachian Electric Power's Charleston district for experimental purposes. In cooperation with Moloney Electric Company and Alcoa, Appalachian is making field tests to find the resistance of the unit to highly corrosive atmospheric conditions. Six-month inspections will be made on the unit which is located near a chemical plant.

MODEL TESTING AT SWEDEN'S ÄLKARLEBY HYDRAULIC LABORATORY

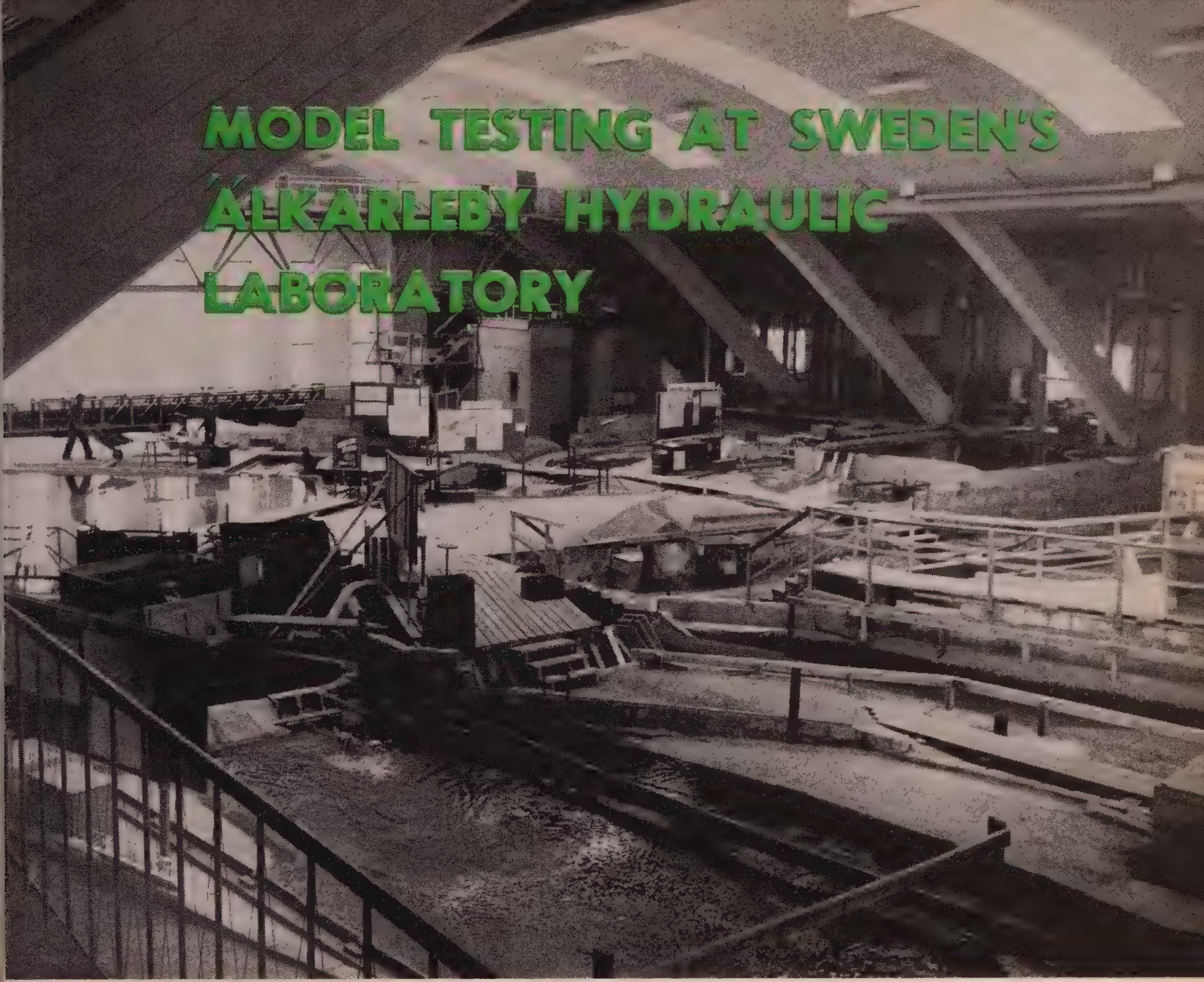


Fig. 2—Interior of the laboratory hall built in 1953.

Solutions to the more complicated problems encountered by Swedish hydro-electric station designers are worked out by means of model tests at the Alvkarleby hydraulic laboratory.

By STIG ANGELIN
The State Power Board of Sweden
Alvkarleby, Sweden

CONSTRUCTION OF a hydro-electric station confronts the designers with many problems of a complicated nature. One of these is that the river is always encroached upon to a greater or lesser extent and, as a result, there is a considerable alteration in the flow conditions. The unfortunate thing is that in the majority of cases it is so difficult to calculate in advance or to judge with any degree of certainty what the conditions will be for various designs of stations.

To remedy this, model tests are carried out to obtain advance information and to arrive at the most suitable design for each component part. It is obvious, of course, that it is infinitely cheaper and less risky to experiment on a small model than on the prototype. Without model tests one is often forced to take expensive precautionary measures against unknown risks and, once the plant is ready, it may then become apparent that the expedients were unsuitable, insufficient or unnecessary.

It is natural therefore that The State Power Board, which is responsible for about half of the hydro-electric building program in Sweden, at an early stage became interested in the technique of model testing. It considered this problem of such importance that a laboratory was built at Älvkarleby.

This laboratory is situated close to the river Dalälven, the total available area being approximately 30,000 sq. meters. The plan of the laboratory site is shown in Fig. 1. Total floor area now available in heated buildings amounts to about

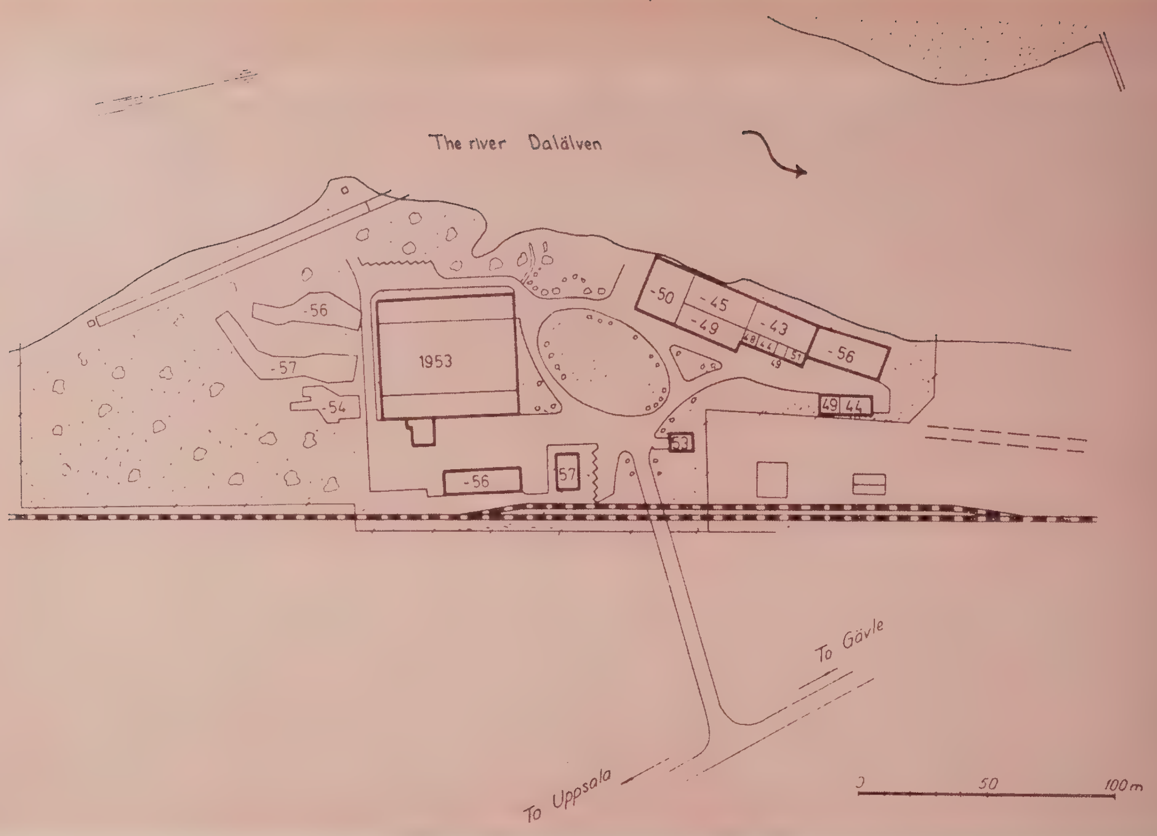


Fig. 1—Plan of the laboratory site. The figures indicate the year of construction.

4250 sq. meters.

An interior view of the laboratory hall built in 1953 is shown in Fig. 2, and the water system for this hall is shown in Fig. 3.

Water circulates from a low-level basin to a high-level basin where it is piped through discharge measuring devices to the models. Once it has passed through the models it is discharged through culverts in the ground back to the low-level basin. Excess water pumped to the higher basin and not needed for the tests in progress is discharged directly to the low-level basin.

Five pumps, each with a capacity of 200 liters per second, i.e., a total capacity of 60,000 liters per minute, are used to pump up the water between 6.7 and 8.8 meters, depending on the water level in the lower basin. The pumps have vertical shafts and the impellers are flooded. They have a shaft horsepower of 44 hp at 1450 rpm. The pumps are located in a separate room which also houses the main electrical switchgear for the hall.

Out of a staff of some 60 persons, 14 are workmen and some 25 engineers and technicians. It should be noted that the technical staff is not only employed on model tests. Its work also includes planning and designing of timber-floating devices

Fig. 4—Model 1 : 100 during testing of the first stage of construction.

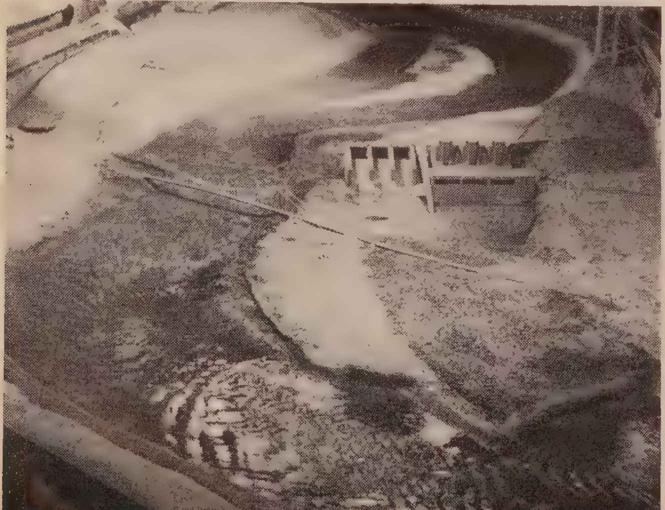
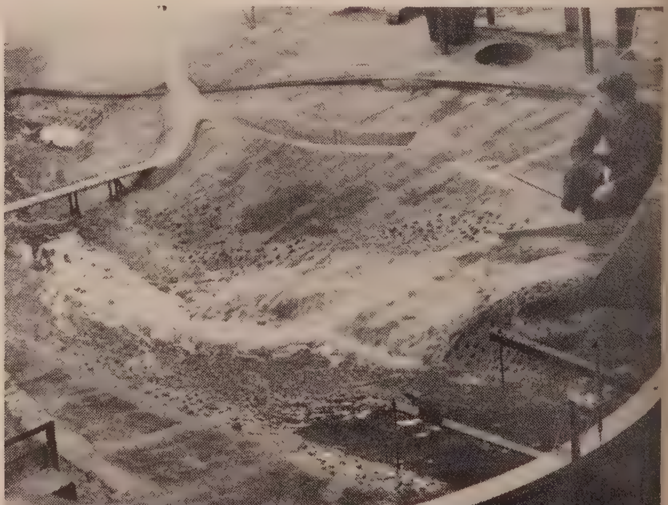


Fig. 5—Model 1 : 40. Tests concerning the flow downstream the spillway section.



for the State Power Board's installations.

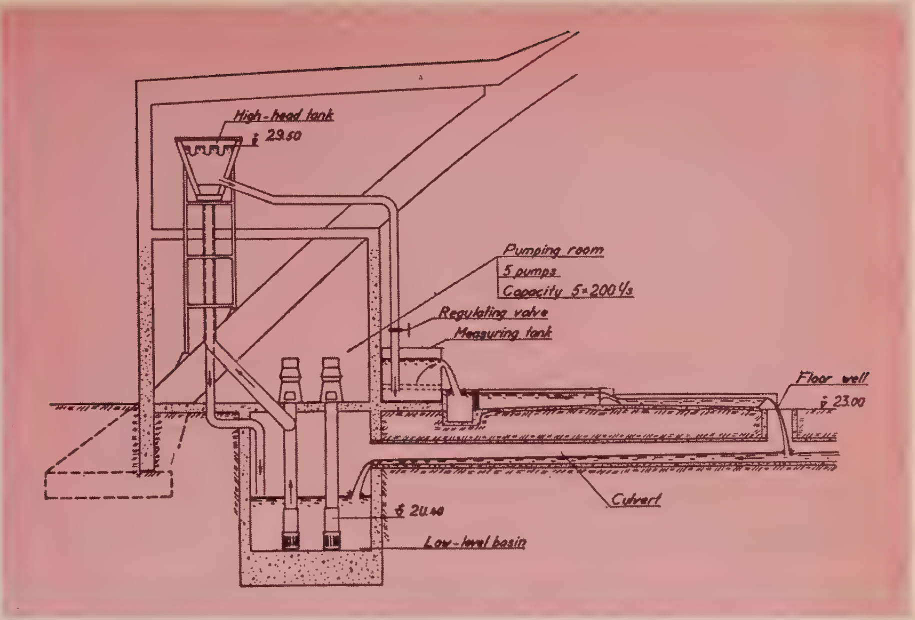


Fig. 3—The water system in the laboratory hall built in 1953.

Testing Program

In order to find the most effective way of using the available floor space one must know the details of the testing program as far in advance as possible, try to estimate for what period the various models will be required and so place them to the best advantage. At the present time about 30 models are in operation and the task of placing them in the halls is like solving a jig-saw puzzle.

The scales normally used here are between 1: 100 and 1: 15. The 1: 100 scale is quite normal for general investigations where detailed studies are not carried out. Very often preparatory tests are carried out with this scale, and from the experience gained, a larger model is built which generally includes a shorter stretch of the river or the installation.

The scale of 1: 40, which is used wherever possible for powerstation models, is sufficient even for most of the detail tests. Scales between 1: 15 and 1: 25 are used for planning individual sections and for detailed studies. Such parts can be gates, stop-logs, certain types of energy dissipators, fish ladders, new untried designs, etc. These parts are often made entirely or partly of plastic glass or are built in a flume fitted with glass walls.

Measuring Technique

For measuring the amount of water, discharge measuring weirs with V-notches are used almost exclusively. The amount of water is approximately regulated by means of large valves in the feed pipe, and a more accurate regulation is obtained by means of 2-3″ valves in the drainage pipe in the measuring tank. The basins are made of steelplate and can be moved easily. For measuring the level of the water in the tanks, and in the models, point gauges are used which are accurate to 0.1 mm.

For measuring the water velocity current meters, Pitot tubes, or floats are used. To chart surface currents the photographic method with intermittent exposing of floats carrying some light source is often used. Earlier the exposure had to be made in darkness, but by using a film sensitive to infrared radiation it can now be carried out in daylight as well. The chart of the flow obtained in this way is especially valuable when estimating the timber-floating problems.

Measurements of hydrodynamic forces on gates and similar structures can be carried out according to two different principles. One approach is to evaluate forces from pressure measurements, the other is to directly weigh the load in the model. The second method will yield results both faster and more reliable. This method of direct weighing, on the other hand, requires a somewhat advanced and expensive model structure. Bearings as well as other areas of contact have to be designed of a low-friction material.

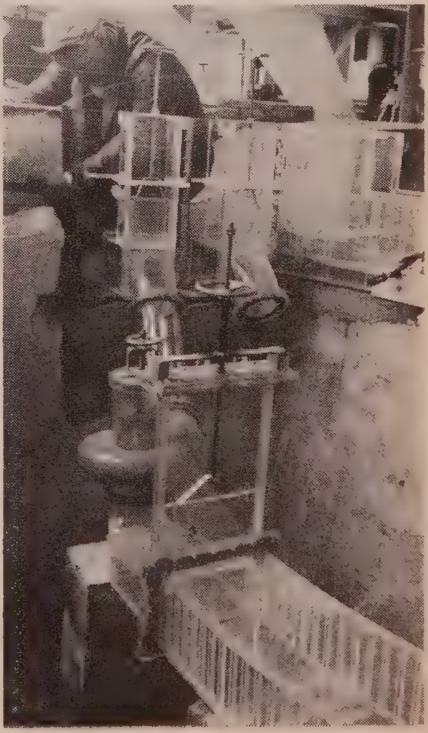
By measuring forces with a dynamometer or balance it is of importance that the measurements are not affected by either transmission characteristics or natural periods of vibration of this. It is obvious that an electrical measuring device is well suited in this regard, as it records both the magnitude of forces as well as any unwanted vibration tendencies that may occur in the structure.

Electrical measurement of static and dynamic characteristics has come more and more into use in laboratory practice. The advantages can be summarized as follows:

1. Measurements require only small amounts of energy, resulting in but small physical reactions on the object of measurements.
2. The electrically analogous quantities are easy to amplify.
3. The electrical measuring cells can be made very small and thus be installed at remote locations of the model.
4. The recording technique of electrical quantities is simple and reliable.

(Continued on next page)

Fig. 6—1 : 60 model made of perspex and liquid plastic.



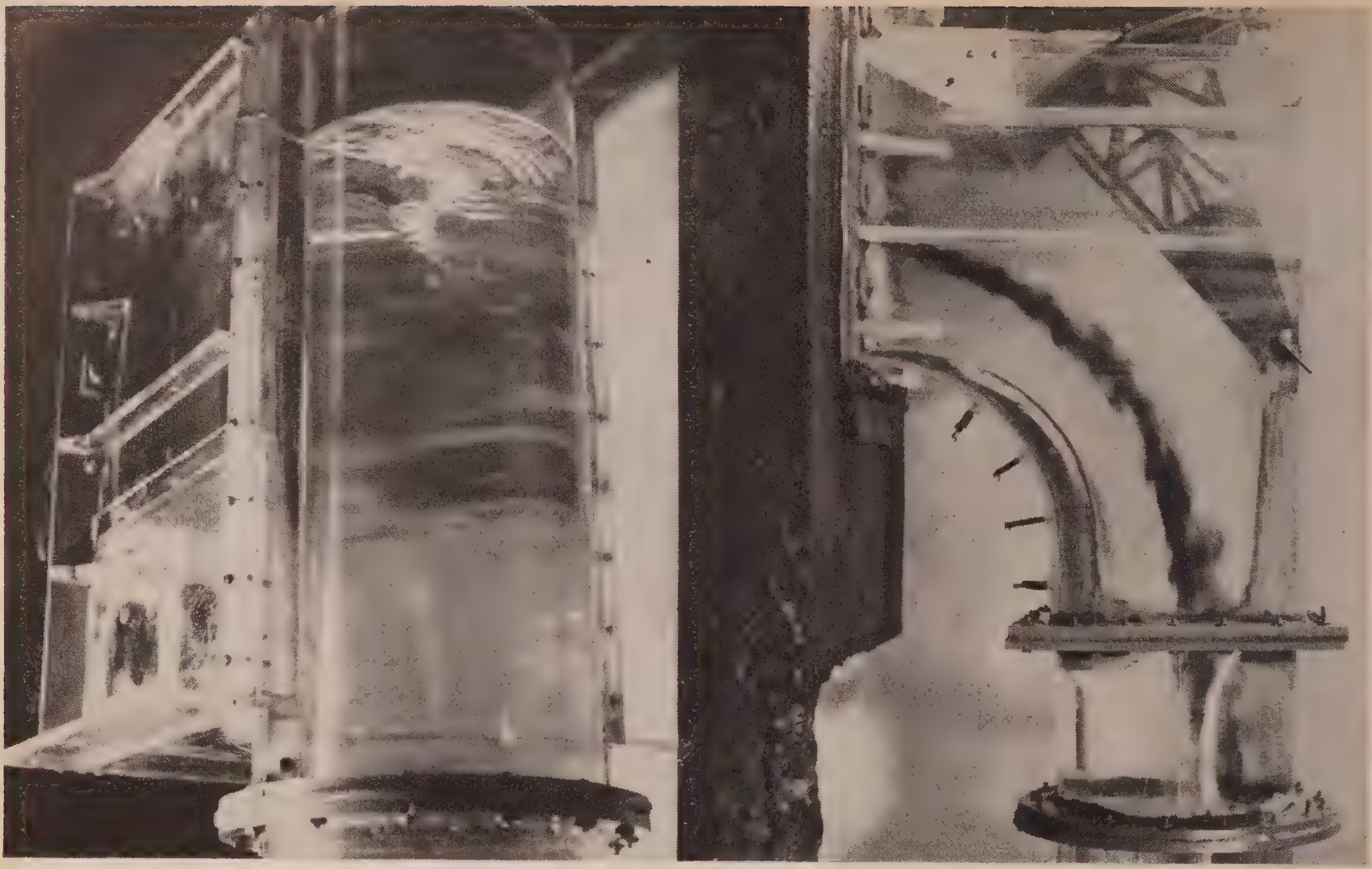


Fig. 7—Unsuitable design of an intake gives vortex flow (left). The final shape of the same intake gives a flow without disturbances (right).

The equipment consists generally of a measuring pick-up connected to a bridge with built-in oscillator. Here the non-electrical quantities are transformed into electrically analogous units and by way of an amplifier channeled into the indicating or registrating instrument.

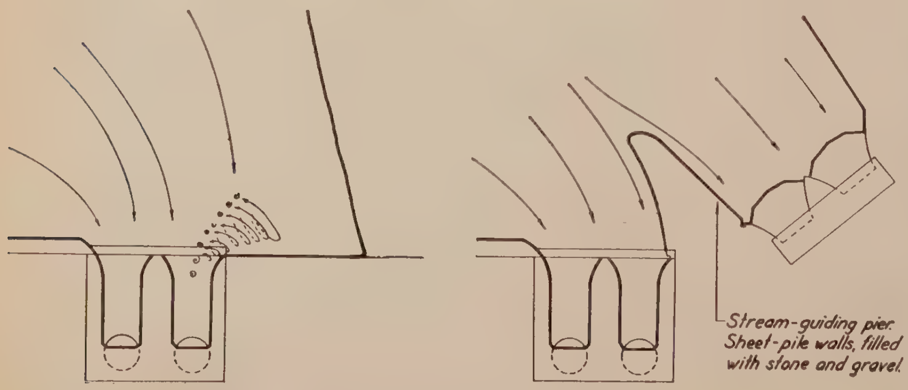
The laboratory disposes of one measuring bridge equipped with a 20 Kc oscillator and thus well adapted to capacitive and inductive gauges, and one with a frequency of 4 Kc, being less sensitive to external disturbances because of its lower feeding frequency and thus better for resistive gauges. Registration is performed by an electrical high-speed recorder with two channels. Recurrent measurements made with the aid of electrical instruments are:

(a) Measurement of forces and loads, using a resistive pick-up with strain gauge.

(b) Pressure measurements of unsteady flow phenomena when conventional manometers cannot be applied. When connected to a Pitot tube, such a pressure pick-up can be used for velocity measurements as well.

(c) Wave measurements. This pick-up consists of an insulated metal wire, partly submerged in the water. The capacitance of the wire is proportional to the submerged length.

Fig. 8—Bad inflow to a power station intake (left) is here improved by measures at the second development (right).



Scope Of Tests

To the present time more or less comprehensive tests have been carried out or are in progress in the laboratory on more than 50 different plants besides a number of independent problems of general interest. Since the tests for each installation have been concerned with many different aspects and have often lasted for several years, it is impossible to summarize them here.

The most usual tasks have been as follows:

1. Position, direction and design of intakes for power stations.
2. Design of spillway sections, discharge capacity, excavations, dissipation, etc., design in detail of gates and similar components and also the determination of forces and loads.

3. Arrangements for timber-floating, such as the placing and design of intakes and outlets for log shoots, spillways usable for log-floating, log storage magazines, guide booms, etc.
4. The placing, and sometimes the design, of fish ladders.
5. Problems relating to the construction period: log-floating, coffer dams, scour risks, etc.

Examples Of The Test Program

Power station intakes

Conditions of flow at a power station intake are of great importance for the operating results obtained in an installation. The intakes of about 20 of the hydro power stations which the Swedish State Power Board has built in recent years have therefore been investigated by means of model tests. The heads used by these plants vary between 7 and 100 m. and the utilized amount of water per generator set varies between 100 and 360 cu. m. per sec. The intention has been to obtain for each plant an intake at a low installation cost which will ensure low losses of head together with a flow which is as free as possible from vortices or other disturbances.

Generally, it has been found that best flow conditions in a power station intake are obtained when the water velocities are continually increased from the upstream opening of the intake to the penstock or spiral case opening, consequently throughout the bend and in applicable cases the transition from rectangular to circular cross section.

Cooling-water intakes

The designing of cooling water intakes for large amounts of water is not as yet a common technical problem in Sweden. Recently, however, model tests have been carried out on the cooling water intake for a large steam-power plant on the west coast of Sweden.

The flow of cooling water will amount to 35 cu. m. per sec. when the plant is eventually built out for its maximum capacity of 700,000 kw. The cooling water is taken from a relatively calm and shallow bay in the Skagerack where tidal variations are very small.

The seawater in the bay has pronounced temperature and density layers. The intention is to use the colder, cleaner water at the bottom as cooling water in order to obtain a higher degree of efficiency and to avoid difficulties with impurities in the water.

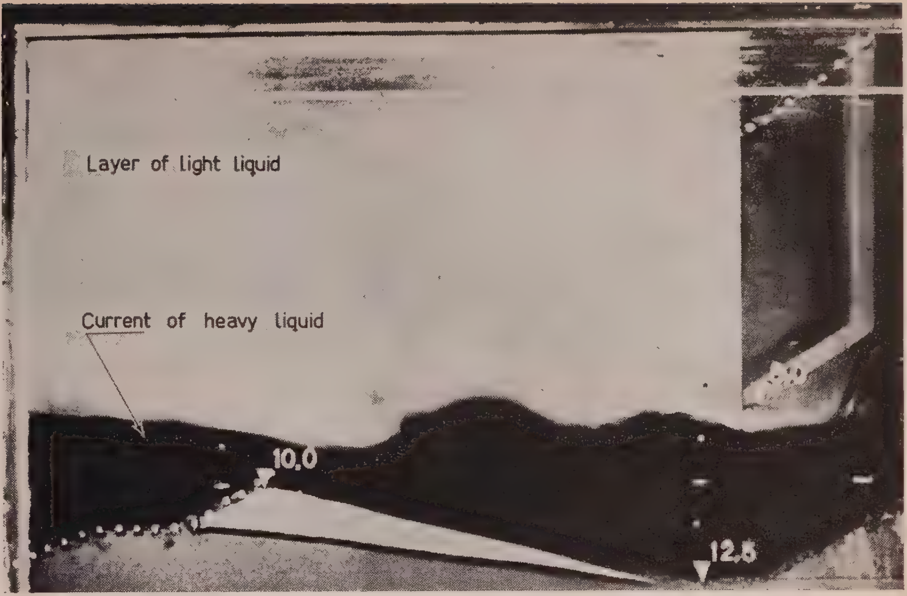


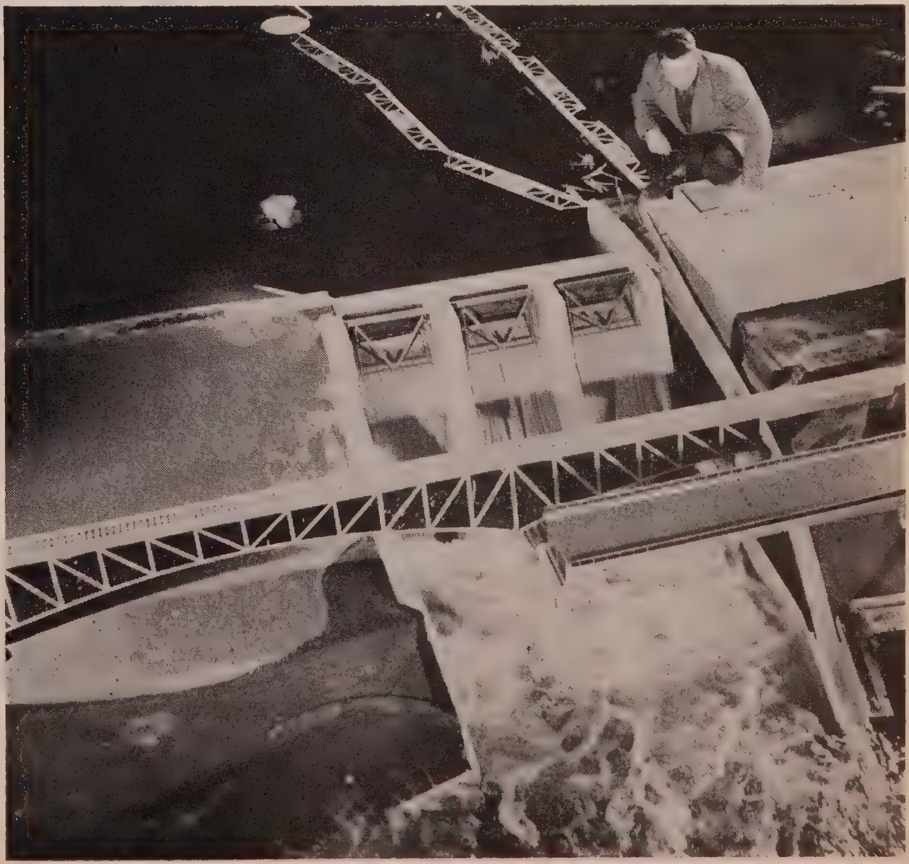
Fig. 9—Internal hydraulic jump in stratified sea-water when discharging too much bottom water.

The problem was treated theoretically parallel with the model tests. The investigations showed that it is possible to construct at a reasonable cost a cooling water intake that will mainly take its water from the bottom layer.

Stilling basins

A rather common problem is to dissipate the energy of the water downstream from the spillways of the dams in order to get so low water velocities that the risk of scour in the river bed and the river banks and damages near the foun-

Fig. 10—Stilling basin and log shoot at normal spring flood, 1 : 40.



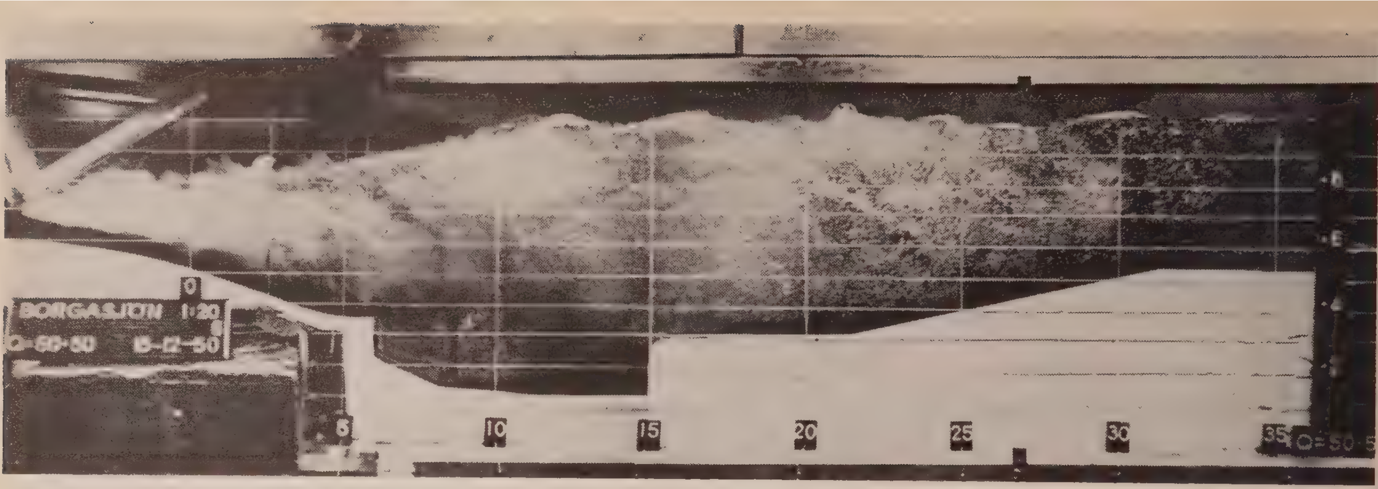


Fig. 11—The energy dissipator at Borgasjon.

dations of piers or dams is eliminated. The design of the dissipators are often influenced by the fact that timber-floating must go on through the spillway openings during part of the construction period.

The storage dam for Borgasjön on the upper reaches of the Angermanälven has bottom outlets for a regulation head of 18 meters with the sill 20 meters below the top water level. For this plant, an efficient energy dissipator has been tested out.

It was calculated that large amounts of water would only be discharged infrequently after the storage dam had been built. An energy dissipator was therefore tested out in which a part of the dissipating, especially at high rates of flow, was achieved by means of a buffeting effect against a concrete wall. To keep costs down the design tested had only quite a small margin of safety.

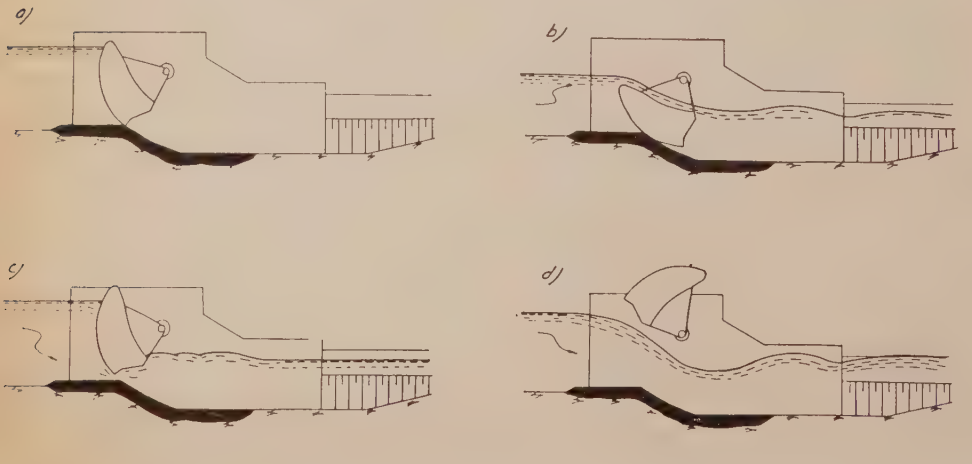
It was found during the tests that if the end sill of the spillway was raised by as little as about 30 cm. (15 mm. on the model) completely different flow conditions occurred which gave a periodically varying flow chart. Instead of the stable dissipation of energy with a calm and even flow in the channel downstream, shown in Fig. 11, there was an oscillation between intermittent shooting surface current via good dissipation of energy to shooting bottom current and also via good dissipation of energy back to shooting surface current all with a constant periodicity of about 30 seconds in the model, corresponding to between 2 and 3 minutes in full scale.

If such currents had occurred in reality, very extensive erosion damage would have been caused and there would have been the risk of the dam being undermined very quickly.

Gate designs

With the help of model tests a number of different types of *gates for log-floating spillways* have been designed. One of these is a cheap and practical type of gate that has been used for the log-floating spillways in the storage dams at Ormsjön, Bodumsjön, Fjällsjön and Malgomaj, and also for one of the spillways at Kilforsen and Stornorrfors power stations. This is a submergible tainter gate that can be used as an ordinary tainter gate or lowered and used as a sector gate for timber-floating.

Fig. 12—The principles of a submergible tainter gate: (a) gate closed; (b) open with restricted water flow (for timber-floating or when for other reason a surface current is wanted); (c) gate used as a normal tainter gate; (d) large flow of water, fully opened.



Tests have also been carried out on a number of different *vertical-lift gates.* These have been concerned with the suction power on the underside of the gates during opening and closing and also with designing a profile for the lower part of the gate so that these loads will be reduced to the greatest possible extent. For closing the diversion tunnel at Harspranget when impounding was about to start, a vertical-lift gate was designed that would be exposed to a maximum pressure of 60 m. of water. In cases of necessity, it would be possible to operate it at this pressure. By altering the design of the under edge of the gate it was possible to reduce the suction from an original figure of 1200 tons to about 400 tons. This, of course, was of decisive importance when the gate and the lifting machinery were dimensioned.

For the Messaure power station a gate has been developed for the diversion tunnel which, during the building and impounding stages, must be able to cope with a flow of up to 800 cu. m. per sec. At full retained water level the water pressure against the gates will be 73 m., but the maximum pressure when the gates are operated will probably be 53 m. After impounding the tunnel will be sealed with a concrete plug.

The solution chosen after exhaustive model tests is a tunnel intake consisting of two vertical shafts, which after 90° bends join to form a common, horizontal, unlined tunnel with a cross section of 140 sq. m. Above each shaft there is a covered gate-housing which has two opposite vertical openings 3.6 x 10 m. These are closed by means of a gate unit consisting of two vertical-lift gates connected to each other by means of framework that takes up the water pressure.

Another method of closure, which has been the object of intense model studies, is the use of *arched beams as stop-logs*. These are often used as a temporary closing of intakes, tunnels, outlets, etc. They are for instance very useful during the building of a spillway-dam at the time the spillway sills are to be concreted between the dam pillars which have been completed at an earlier stage of the work.

When the flow is to be shut off, the bow-shaped beams, supported on guide beams on the nosing of the pillars, are lowered through the water to a sill on the bottom and are piled on top of each other to form a temporary arch dam in front of the outlet.

The type of beams used earlier, however, could only be used in calm water or at low discharge. When the flow reached a certain critical limit or exceeded it, the beams could not be lowered and they remained swinging up and down in the water a little distance above the beam lowered before.

The model tests have given a more suitable beam section and this, if it is fitted with suitably designed and placed vanes, can be used in almost all conditions. The new type has been used with good results at several plants at a discharge of up to about 600 cu. m. per sec. in one 15 m. wide spillway opening. In spite of considerably greater rigidity and height the new stop-logs are cheaper than the old type.

Summary Comments

Provided that the model has been correctly designed to a suitable scale, based on reliable field data and the solutions in the models carried out in the same way in reality, it has been found that the results obtained in the model and the prototype agree extremely well. Naturally, there are discrepancies connected for instance with surface tension, so that for example, the amount of air entrained in the water in energy dissipators is much greater in the prototype than in the model, but this is mostly a surface effect: the flow picture remains the same.

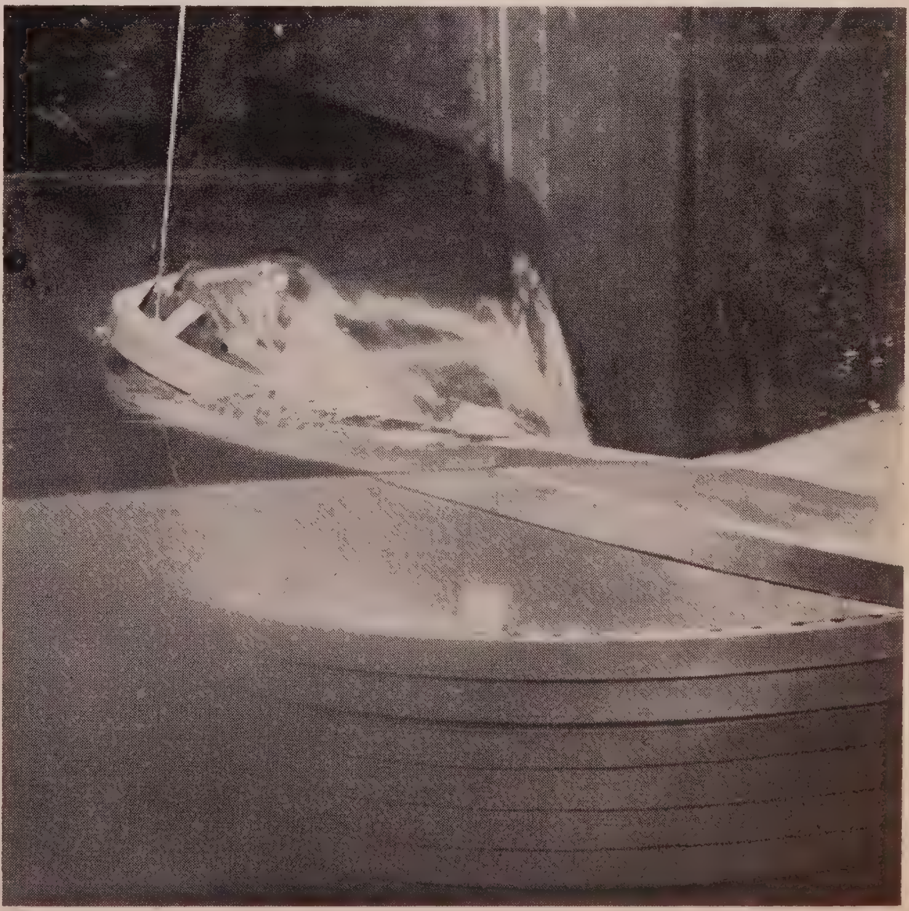
Model tests are carried out to such extent that the costs altogether amounts, on the average, up to approximately 0.3% of the building costs for each plant. This includes a rather fast depreciation of buildings and equipment, costs for heating, snow-clearing, offices and so on.

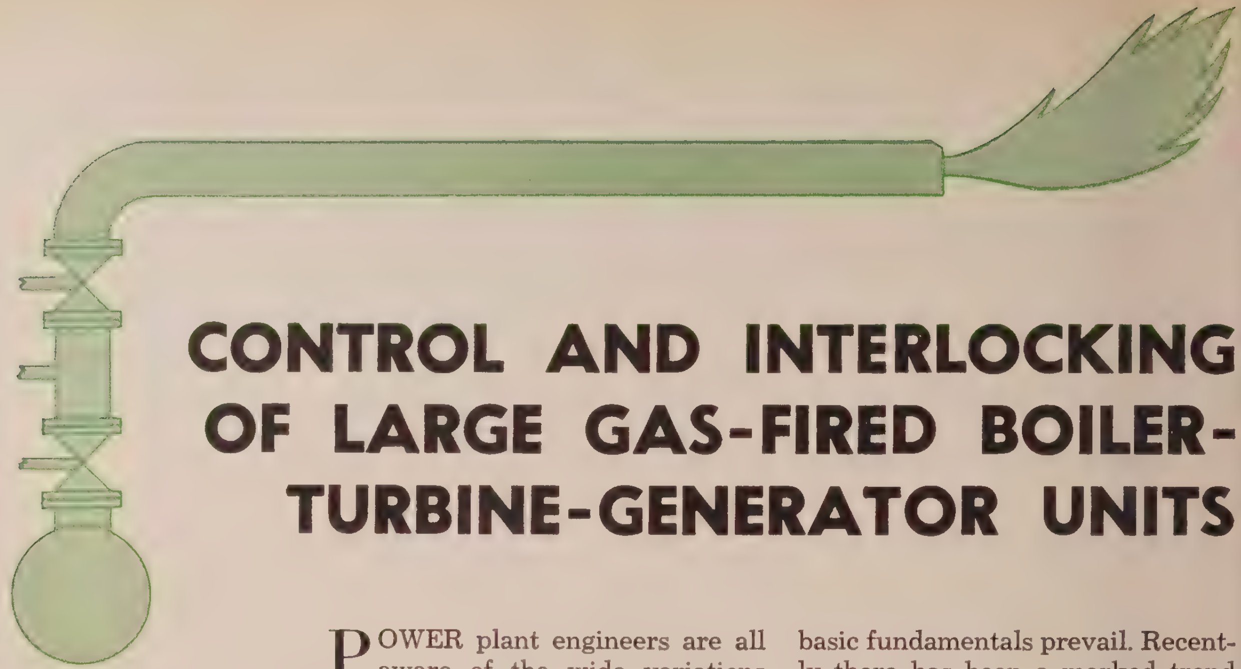
There is a saving on the construction costs of the installation since experiments can show the most economical solution without recourse to more or less uncertain calculations or judgments. Often the model tests also make it possible to choose new designs or construction methods, which would have been unrealizable without being tested and adjusted in a model. These savings may often be very large and we are fully convinced that they have already paid many times over the cost of the buildings and of the tests. One could define this profit by saying that from a hydrodynamic point of view one can reduce the safety factor to just above 1.0.

During the construction period it is of great value to have a model available in which one can test immediately various alternatives in connection with heights of coffer dams, scouring risks, timber-floating, etc. This is especially noticed when unforeseen occurrences or difficulties arise which, for example, causes that the direction of a coffer dam needs to be altered, or if the complete work sequence needs to be changed.

It is very useful to have the model also on occasions when it is realized that the assumptions made concerning for instance the depths to bedrock were not correct. Alterations of this kind occur so often that the extra cost of retaining the model until a full general idea of the building work is obtained or until the plant is in operation is generally repaid many times over.

Fig. 13—Immersion of arched beams as stop-logs in flowing water (model 1 : 15).





CONTROL AND INTERLOCKING OF LARGE GAS-FIRED BOILER-TURBINE-GENERATOR UNITS

By LUDWIG SKOG, JR.,
and EDWARD H. FINCH,
Associates
Sargent and Lundy

Automation will require more reliance on quality components, application of continuous self-checking circuitry; much closer cooperation between electrical and mechanical engineers is essential to understand each other's problems.

POWER plant engineers are all aware of the wide variations that exist between plants with respect to control, interlocking, and protective schemes employed for large gas-fired boiler-turbine-generator units. These variations exist not only between utility operating companies, but also, in many cases, between plants operated by the same utility. However, it appears that some degree of standardization has been reached in boiler combustion control systems, circulating water systems, turbine protective devices, and most of the elements of the boiler feed water system. The most important differences that are still unresolved are: 1. Boiler ignition and burner protective systems; 2. Interrelation of boiler-turbine-generator interlock; and 3. Protection system against loss of a boiler feed pump.

It is the intention of this paper to present a workable scheme of the control and interlocking in each of these controversial areas. It is hoped that it will bring out discussion of the merits of the fundamental ideas, and lead to some degree of standardization in the protective schemes employed.

Boiler Ignition and Burner Systems

Automatic control of the ignition and fuel supply of large, modern, gas-fired multiburner units is considerably simpler to apply than in the case of similar units built for coal or oil-firing, although the same basic fundamentals prevail. Recently there has been a marked trend toward more automation in the light-off and operation of large boilers (Fig. 1). Past practice has been built on the premise that no group of electrical or mechanical components is as reliable as the human eye, and no interlocking or protective system could be devised that could be substituted for a well-trained operator's judgment. This premise is still true, to a large extent. However, it is open to serious question as to whether even the best operator's judgment and experience can be relied upon for the correct decision every time. Size, cost, and complexity of the modern gas-fired plant has increased to a point where even one mistake cannot be tolerated, because of the hazard and cost of a catastrophic boiler explosion. This has led to an intensive development of systems and components for more-or-less automatic light-off and protection of the boiler.

At the present time, however, it is felt that the most logical system to follow on boiler light-off is a semi-automatic scheme, in which the operator initiates each step of the procedure, preferably from some remote location such as the control room. In this system each step is completed automatically and its successful completion is monitored back to the operator, who then may manually initiate the next step. Sequence of the steps is made mandatory by suitable interlocks. An error by the operator, or failure of any component trips out either the indi-

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Editor's Note: This is an adaptation of a paper presented by the authors at the 22nd Annual American Power Conference, March 1960.

vidual burner at fault, or the complete supply and forces a fresh start.

As experience is gained and components are improved from a reliability standpoint, this system can be made more and more automatic. The ultimate goal could be the complete light-off of a boiler from a cold start with a single push button operation. However, it is felt that it would be highly desirable to proceed toward this goal through several interim stages, until the complete reliability of the components has been proven, and the operators have become familiar with all facets of the system.

Briefly, fundamental design considerations for such a light-off system should be as follows:

A. *Purge Cycle*

The boiler should be put through a purge cycle for a minimum of five minutes, controlled by a definite interval timing relay. Before the purge cycle can be started the following conditions should be proved out by suitable interlocks: 1. All burner valves closed; 2. All burner air registers opened; 3. Main gas shutoff valves closed; 4. Igniter gas shutoff valves closed; 5. One or more fans in operation; 6. Minimum air flow established across boiler; 7. Normal boiler water drum level established; 8. Normal voltage established on control power bus.

If any of these conditions are interrupted during the purge cycle the purge timer should automatically reset to zero, thus forcing a complete repetition of the purge operation after trouble is cleared. Successful completion of the purge cycle should be indicated to the operator, preferably by a "purge completed" indicating light.

B. *Ignition and Burner Operation*

After successful completion of the purge cycle both the main burner header safety shutoff valve and the main ignition header valve can be opened, provided the following conditions are proved out by the interlocks: 1. All burner gas valves closed; 2. All burner air registers closed; 3. All igniter valves closed; 4. No pilot flame or burner flame, as indicated by flame detector; 5. Normal voltage established on control power bus; 6. One or more fans in operation.

It is desirable to provide indicating lights at the operator's control station to indicate position of all valves. Additional indicating lights should be provided to indicate that correct gas pressure has been established in both the burner header and the lighter header.

The operator may now energize the first pilot igniter circuit from his control station provided the correct gas pressure has been established in the igniter header. Operation of the pilot igniter switch or push button opens the two valves associated with that lighter, closes the vent valve, energizes the ignition transformer, and opens the air register to the lighter position. If ignition occurs successfully a "flame on" light should indicate at the control point thus notifying the operator that he can light off the associated burner. The flame detector also acts as the permissive interlock to permit opening the valve of the associated burner. The operator may now operate the burner light-off switch which opens burner gas valves associated with that burner, closes the vent valve, and drives the air register to the burner position, provided the correct burner header pressure has been established. The igniter may be shut off at this point and the "flame on" indicating light will remain on if burner flame has been established. The flame detector continues to act as a protective interlock with its individual burner, and will operate to close the burner valves and open the associated vent valve if flame is lost on that burner for any reason.

In the event that the burner flame of the initial burner fails to be proven after a selected time delay, the entire light-off operation should be forced to return to the start of the purge cycle.

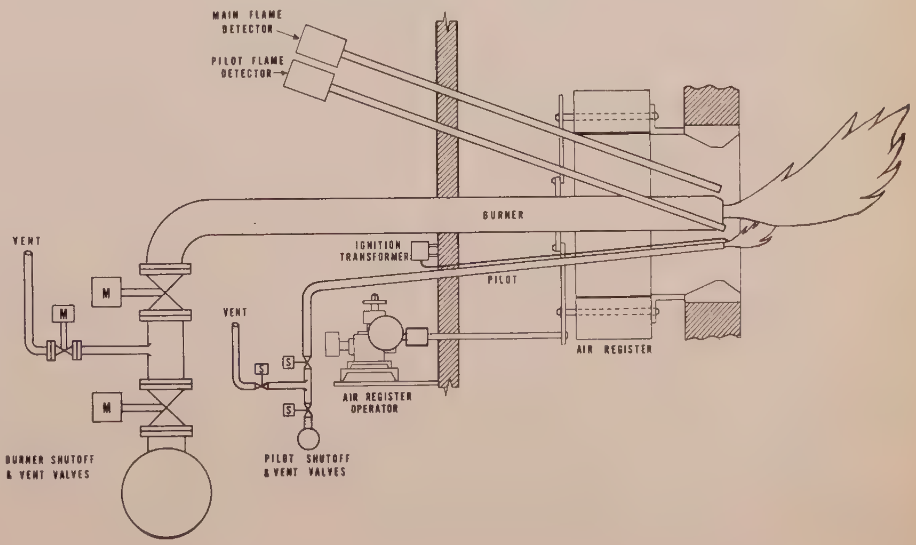
Some systems now in use enjoy a single switch for the lighter-burner combination. In this case the lighter operation is similar to the above, but, in addition, a time delay relay is energized at the start of the operation. If lighter flame is established within the time limit, burner valves and air registers open automatically. The igniter may also be set to drop out automatically after burner flame has been satisfactorily proven. This is a time-saving device and will find increasing favor as the operators gain more faith and experience with the components that make up this system.

C. *Boiler Trip Interlocks*

After the boiler has been put in operation, main safety gas shutoff valves for burner headers and lighter headers will be tripped closed (and the vent valve opened) for any of the following conditions: (Fig. 2): 1. Tripping of all fans; 2. Loss of gas pressure in the burner header; 3. Low water level in boiler drum; 4. High water level in boiler drum; 5. Excessively high pressure in furnace; 6. Manual operation of emergency fuel trip switch; 7. Loss of all flame.

The reason for tripping in the event of either Items 1 or 2 is quite obvious and requires no additional discussion. Items 3 or 4 are tripping functions that the majority of boiler

Fig. 1—Ignition and flame detection system.



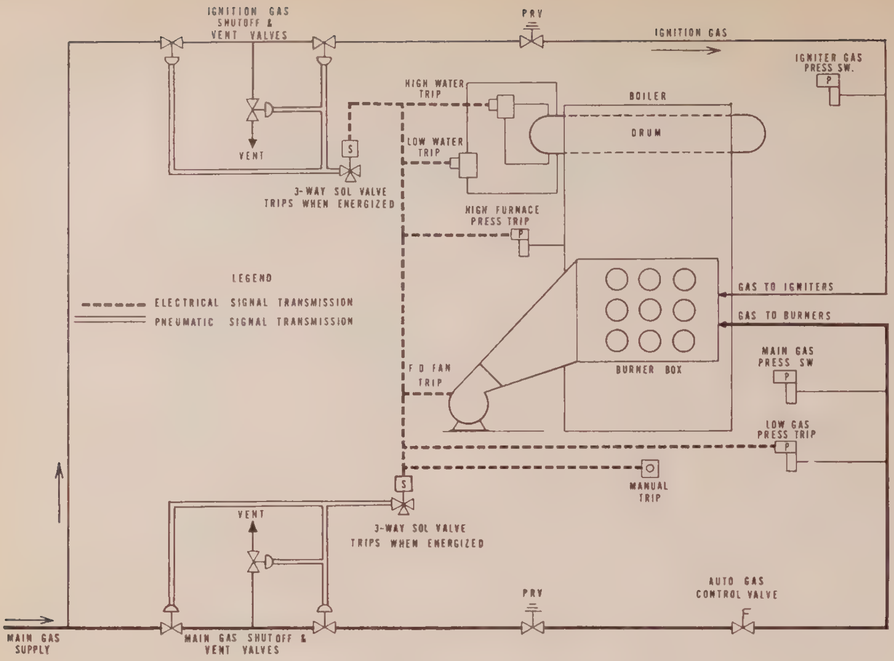


Fig. 2—Simplified fuel gas diagram and boiler protective system.

manufacturers are recommending strongly, as units increase in size. These were considered to be only alarm functions in the past, but the trend appears toward changing them to trip functions, especially in plants operating with minimum personnel. Pretrip alarms are desirable on these functions to warn the operator that corrective measures should be taken to avoid a trip.

Item 5 is intended in the event of a severe tube rupture or furnace explosion, and would serve as a back-up to individual burner valve trip functions actuated by flame-failure detectors. This interlock also becomes more and more desirable as operating personnel is reduced to a minimum.

Item 7 covers tripping of main safety shutoff valves in the event of loss of all burner flame after the unit is in operation. It is obvious that this is a form of back-up protection, inasmuch as flame detectors would also close individual burner valves associated with each flame detector. However, many operators are concerned over the possibility that a slug of air, or noncombustible material, can come over the gas line and cause complete loss of flame for a few seconds, without causing any change in burner header pressure. If any one of the individual burner valves failed to close properly, or if any individual flame failure interlock failed to work during such an emergency, an explosion could result upon resumption of gas flow. It is felt that severity of consequences warrants back-up protection in such a case.

Tripping of main safety shutoff valves should always force a complete restart, starting with the purge cycle, before firing can be restored.

Control power to a boiler ignition and burner system is of sufficient importance to warrant additional discussion. The usual source of a-c in a power station is subject to momentary interruptions during throwover, and may be subject to considerable voltage fluctuation during major power system disturbances. This is obviously intolerable for an automatic fuel ignition and burner system that must be as closely interlocked as is indicated. However, the designer will find that devices and components he must work with have much greater reliability when operating on a-c than they have on d-c. For this reason, a control power source from the station battery, using an inverter to supply a-c to boiler controls, is preferred. Two duplicate sources, with control and interlocking of one-half of the boiler fed from each source, is recommended for maximum safety and reliability.

Interrelation of Boiler-Turbine-Generator Interlocks

Recently a working group of the AIEE Power Generator Committee presented a paper, No. 59-1149, entitled "Minimum Recommended Protection for Unit-Connected Steam Station." This very excellent paper co-ordinates protection of the electrical end of the unit with that of turbine and boiler, so that trouble in any part of the unit causes partial or complete shutdown depending on the type of trouble involved.

This paper reflects a current change in the basic philosophy of tripping by a large number of operating utilities. In the past it has been considered of prime importance to protect the power system against false tripping of a unit, which may occur whenever the number of tripping devices in any particular plant are multiplied. However, as more units are added to the system, and the cost of plant equipment, and the consequent cost of a failure to clear a genuine case of trouble are multiplied, there has been a strong tendency to regard the protection of the unit as of prime importance.

Fig. 3 shows in tabular form a basic scheme for application of these tripping interlocks. It is obvious that some variations in details of application must be made to provide for differences in equipment as supplied by various manufacturers, however these details should be checked back to determine that they agree with the fundamental plan.

Basically the interlocking scheme should be designed to function as follows:

A. Generator Protection

Operation of generator differential relays, main power transformer differential relays, unit auxiliary transformer differential relays, or generator neutral ground relays is generally indicative of a definite fault in the generator of its directly-connected equipment. Operation of any of these devices will trip a lockout relay, usually designated as the primary tripping relay. This primary tripping relay trips the following devices: 1. Generator circuit breaker; 2. Generator field circuit breaker (and exciter control field contactor if required by manufacturer); 3. Unit auxiliary circuit breaker. (Will usually initiate automatic transfer to reserve supply when this is provided); 4. Turbine main and reheat steam valves; 5.

Boiler fuel supply.

Other generator protective relays, such as negative sequence relays, loss of excitation relays, voltage-restrained overcurrent relays, etc., are generally considered to be back-up protection. Operation of most of these relays is generally associated with a fault outside the zone of the generator and its directly-connected equipment, which has failed to clear up by normal means. In the recent past it has been considered sufficient for these relays to trip the generator breaker only, leaving the unit under the control of the emergency governing system in order to decrease time required to get the unit back on the line. This has been based on the fact that these back-up relays are chiefly concerned with protection of the generator against overheating, and this overheating usually requires sufficient time to allow a decision as to whether or not to trip the turbine. However, at the present time the trend is toward reducing the number of operators, and recent developments in design have reduced the time before serious overheating of the generator occurs. For example, recent developments in conductor-cooled generators have resulted in a reduction of negative sequence current capability so that the generator reaches the limiting temperature in one-third the time it takes for the conventional machine. The generator of the future will very likely have even faster temperature response. These factors, plus a natural reluctance to place complete dependence on operation of the overspeed devices, have made it more desirable to trip the same devices with the back-up relays that are now tripped by the primary relays. Most of the large new machines installed have been connected in this manner.

Tripping the unit by means of the generator field ground detector relay is also a rather recent concept. This device has generally been used to sound an alarm only; however, the serious damage that could result from the occurrence of a second ground before the first could be cleared, has tended to advance this to a tripping function.

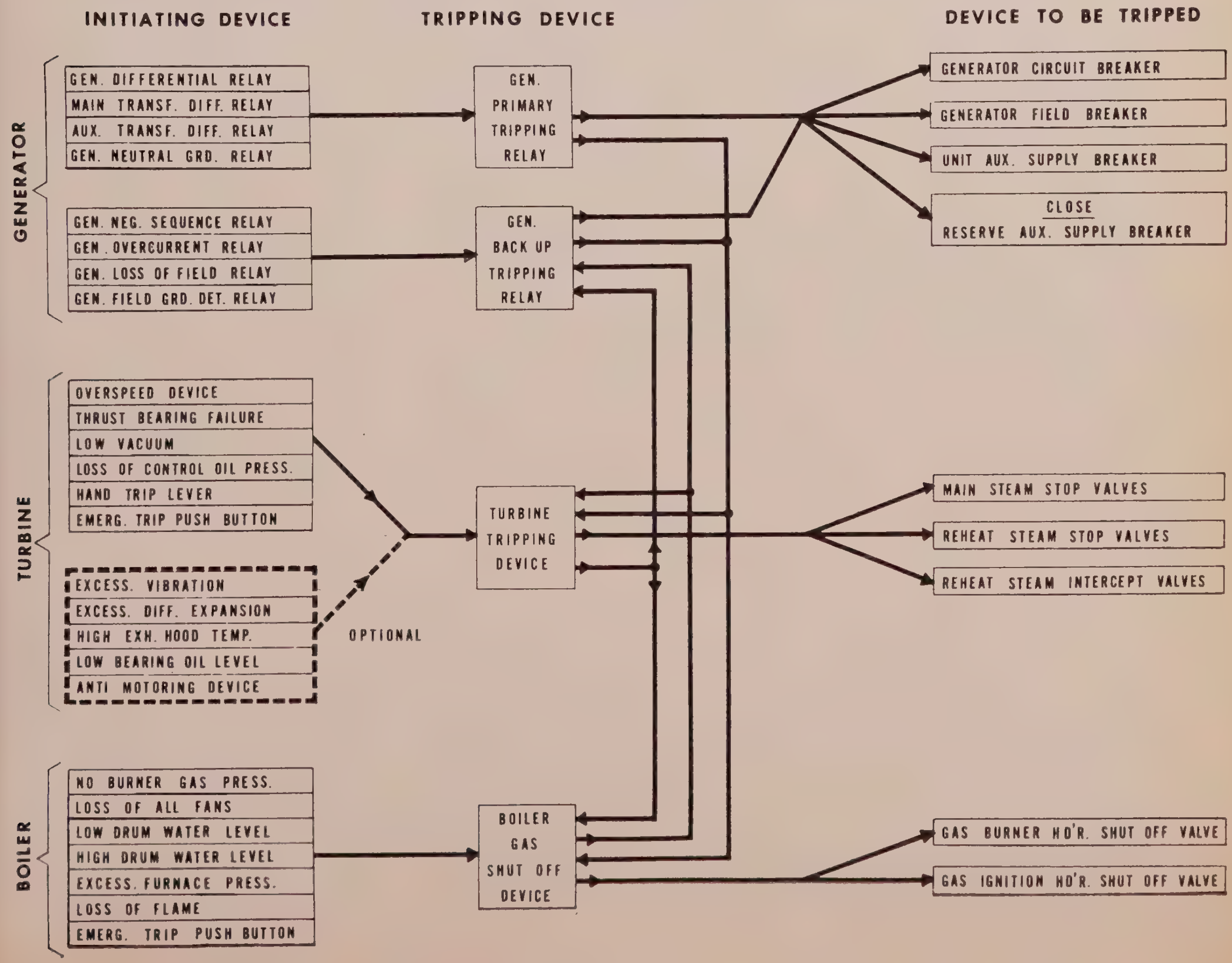
B. *Turbine Protection*

All turbine manufacturers recommended closing off all steam to the turbine immediately in the event of overspeed, thrust bearing failure, or low vacuum. Inasmuch as a motoring generator could intensify any damage to the turbine, the generator circuit breaker should be tripped also, as well as the generator field breaker and the unit auxiliary breaker. The boiler fuel supply should also be tripped immediately on all reheat units.

Turbine steam valves are dependent upon hydraulic oil pressure of the turbine to remain open. Loss of this pressure will close these valves and trip the same devices listed above, hence the turbine is inherently "fail-safe" upon loss of control oil pressure.

A considerable difference of opinion exists as to whether the turbine should be tripped automatically, or

Fig. 3—Interrelation of boiler-turbine-generator interlocks.



whether an alarm should sound and the decision to trip left to the operator, for the following conditions: 1. High exhaust hood temperature; 2. Vibration; 3. Differential expansion; 4. Motoring; 5. Low oil reservoir level.

Opposition to tripping the unit from any of the above operations stems largely from a lack of faith in the reliability of the devices that have been used to initiate the trouble signal. It has been felt by some operators that the number of false trips that may occur outweighs the protection afforded by the device. Although one must sympathize with the operator's viewpoint in this case it is basically wrong to hold off tripping the turbine on a trouble signal when subsequent serious damage can result from a failure to trip. For example, a high exhaust hood temperature alarm generally indicates that the operator has only a short time in which to take corrective measures before damage occurs to turbine blading.

It would be logical to feed this alarm signal through a time delay relay and trip the turbine within the time specified by the manufacturer, if temperature was not reduced to a safe value in the meantime. This would protect the turbine even if the operator was not available to take necessary corrective measures. Some operators, however, do not trust this device sufficiently to use it as a tripping function, and it is often found connected to alarm only. This points up the need for better components, of unquestionable reliability, so that important protective functions are not lost due to lack of faith in the device.

C. *Boiler Protection*

In the majority of installations neither the turbine steam valves nor the generator breaker is tripped when a boiler fuel tripout occurs. Many fuel trips are due to causes that can be corrected within a relatively short time, and the unit can thus be restored to normal operation with a minimum of trouble. During the time the unit is operating without fuel, turbine load is reduced by operation of the initial pressure regulator and steam is supplied from residual heat in the furnace. If the fuel supply outage is found to be of a lasting nature, steam valves and generator brakes are generally tripped manually by the operator, and the unit is prepared for a shutdown.

Recently, however, some boiler manufacturers have pointed out that this practice results in rapid cooling of boiler pressure parts, and results in a severe thermal shock. They have recommended that turbine main and reheat steam valves be tripped immediately upon tripping of the fuel supply in order to "bottle up" the maximum amount of heat in the boiler. Tripping of turbine valves would, of course, also trip the generator breaker, field breaker, unit auxiliary feed, and initiate a transfer to reserve supply where such automatic throwover has been provided.

Consideration of the pros and cons of this argument usually revolves around whether it is simpler to restore fuel supply to the boiler, after trouble is corrected, or whether it is simpler to reopen steam valves, bring the unit up to speed, and resynchronize. There are two additional points, however, that should be considered fully in any evaluation of this problem. The first of these involves the thermal shock to the turbine if the steam valves are left open. The large, modern, high-pressure, high temperature boiler does not have the residual heat capacity of older boilers, and temperature and pressure of the steam start falling rapidly after a fuel trip-out. If the boiler has a mandatory purge cycle before fuel can be restored it will cool the unit still further. All of these factors can contribute to a rather rapid decrease in temperature and a hazardous condition at the high-pressure end of the turbine as well as in the boiler.

The second point to consider is the possibility of an error in operator's judgment if the unit is still synchronized to the line and running on residual heat in the boiler. Assuming that the cause of the fuel trip-out is temporary and can be corrected, there is still liable to be a touch-and-go situation with respect to restoring fuel to normal within the allowable time. In order to save time the operator may decide to bypass some of the interlocks that ordinarily force him to light off in a mandatory sequence, with disastrous consequences. Most of the furnace explosions that have been reported during recent years have occurred during the start-up cycle, and a disturbing number of these have been involved, to some extent, with an error in judgment.

It is expected that this interlock, involving tripping of turbine and generator in the event of a fuel failure, will find increasing favor on future jobs, and will be applied in some manner to suit the particular system involved.

Protection Against Loss of a Boiler Feed Pump

Size and cost of boiler feed pumps for a large modern unit have increased to a point where considerable study is required in order to arrive at the most economical and practical solution of this problem. In some recent cases this has resulted in application of steam-driven pumps and, in other cases, in pumps driven from the turbine-generator shaft. The majority of installations, however, continue to use electric motor-driven pumps. In a number of recent cases this equipment has consisted of two nominal half-sized pumps.

Some tests have been made on recent installations which indicate that if one pump should fail during a high load condition the drum water level will drop below the minimum gauge glass indication before turbine load can be reduced by normal controls. Inasmuch as most boiler manufacturers are recommending that the boiler fuel be tripped automatically by low drum level, this will result in tripping the entire unit off the line.

The basic problem is to quickly reduce steam flow to correspond with maximum possible output of a single pump. This may be accomplished in many installations by using a signal from the feed water control system (indicating a large deficiency between feed water flow and steam flow) to reduce turbine-generator load to a predetermined safe operating point for a single boiler feed pump.

In some installations, design of gas burners is such as to require tripping of one or more rows of burners when a boiler feed pump

(Continued on page 65)

A PROGRESS REPORT

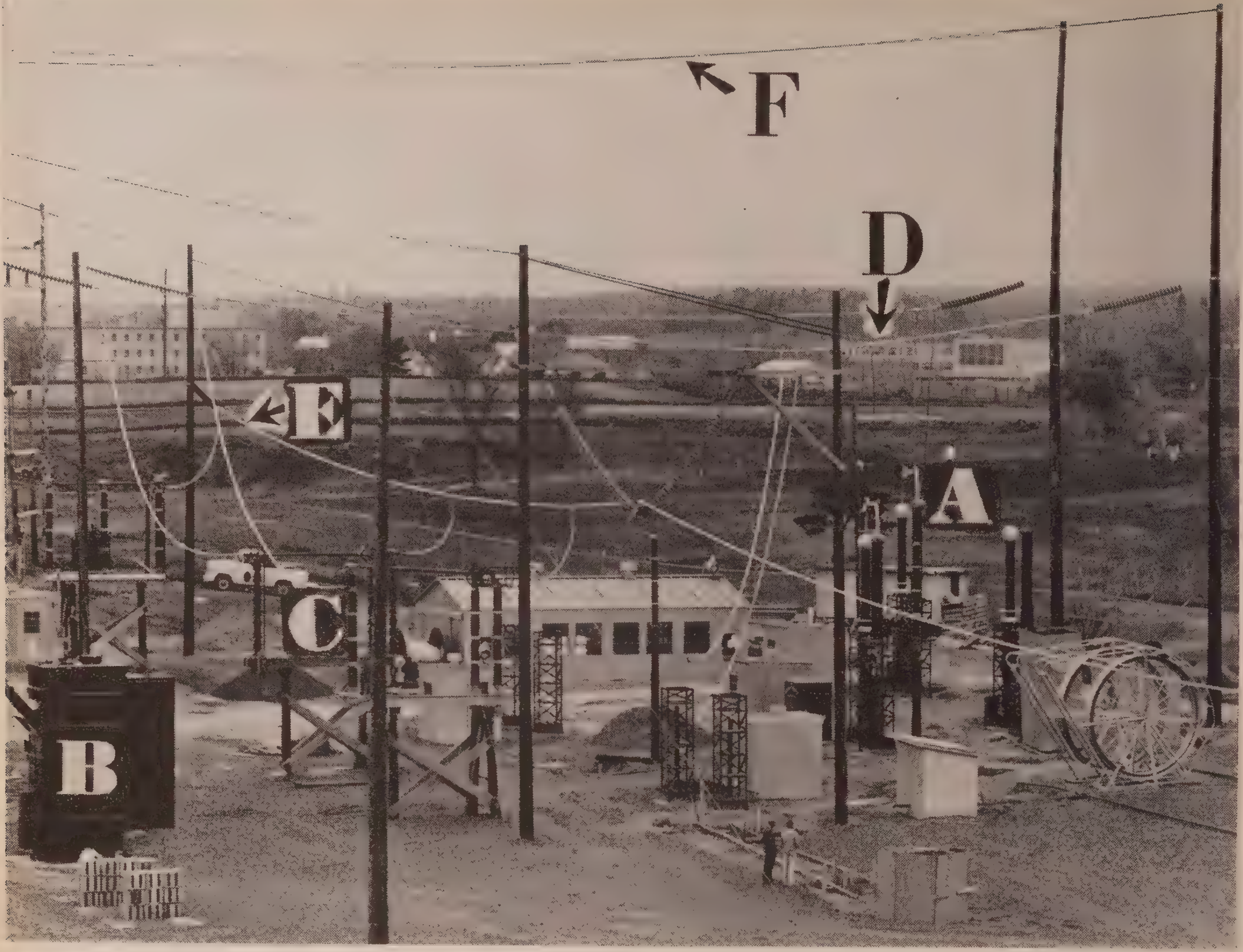
CORNELL EHV CABLE PROJECT PASSES MILESTONE

BY JULY 1, the research project on 345-kv underground cable and accessories at Cornell University should be past its first important milestone with four cables installed and trial measuring techniques under way, according to the Joint AEIC-EEI-Manufacturers Steering Committee on Extra-High-Voltage Cable. Underground structures are complete, overhead test bus and switching equipment have been installed, New York State Electric and Gas has completed its 23-kv feed line, and the necessary station equipment is in place. Official opening of the testing station is scheduled for the first half of September.

All of the cables that have been produced by the four cooperating cable manufacturers incorporate improvements over past practices, including improved properties in the oil-impregnated paper insulation. Three cables have 2,000,000-c.m. conductors, while the last one has a 1,700,000-c.m. conductor. The Okonite Company furnished a high-pressure, oil-filled, pipe-type cable which was installed in December 1959. Phelps-Dodge Copper Products Corporation supplied a self-contained, high-pressure, oil-filled cable with aluminum sheath which was installed in February in concrete encased Transite ducts. General Cable Corporation's high-pressure, oil-filled, pipe-type cable was installed in April, and the Anaconda Wire and Cable Company's low-pressure, oil-filled cable was scheduled for installation in June, also in concrete encased Transite ducts.

Each of these cable manufacturers developed a 345-kv cable for this project with the understanding that each of them could also make cable of any of the other types.

Every effort has been made to make the installation of the cables as nearly as possible similar to commercial practice in the United States, yet to keep costs of the test station and its operation as low as possible. This resulted in the decision to make each underground cable installation single-phase rather than three-phase and to use wood-pole construction for the overhead test bus structure.



Test Station at Cornell University in May, 1960. A—Terminals of cables to be tested; B—One of the 500 KV transformers (without HV bushings); C—HV disconnect switches; D—Main test bus (2 phases); E—Test bus for power-factor measurements; F—Ground wires for lightning protection.

Each cable is in the form of a closed loop with current transformers installed on the riser section. Thus current will be induced in the cable conductor to heat it to the desired temperature. The cables will be energized by connections from the overhead test bus to the potheads.

At 10-ft intervals there are thermocouples attached to the pipe or duct to measure the temperatures. In addition, thermocouples are installed at various locations on the cables, on the riser pipes, and on joints and terminals.

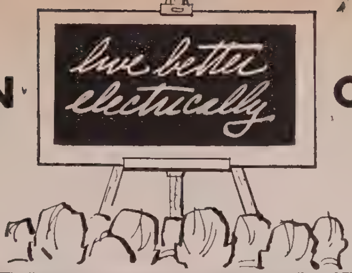
The joints were supplied by each cable company for its cable and the potheads were supplied by G & W Electric Specialty, Ohio Brass and Anaconda Companies. A number of new developments were incorporated in these accessories.

Since one of the three 500-kv transformers which were formerly used in the tests at Tidd, Ohio is still in operation in the high altitude tests in Colorado, the test voltage will be supplied by two transformers which Westinghouse Electric Corporation is lending for the duration of the Cornell field tests. In order to balance the power supply on the three-phase line of the local utility, Westinghouse has provided a 69-kv capacitor bank to take the place of the third transformer. General Electric Company has loaned the 23/69-kv supply transformer to feed the Tidd transformers. Many other electrical equipment suppliers are donating or lending different kinds of electrical equipment for this project.

The test program for the first two years is intended to determine the ability of the cables and accessories to operate commercially at 345-kv, three-phase and to carry loads up to at least 500,000 kva. In the third year of testing, still higher test voltages and loads will be applied to determine ultimate limits on feasible dielectric stresses and temperature. Temperature and power factor measurements will be made periodically to detect any signs of instability of the insulation.

Preliminary tests in the manufacturers' laboratories showed very low dielectric losses, a characteristic which is essential to the successful transmission of bulk power at extra high voltage. Electrical properties of these cables appear to conform to, or perhaps even exceed, the original objectives. If the installations come through the Cornell field tests with flying colors, the electrical industry will have available underground cable systems which may be installed and operated successfully under American conditions in the 345-400-kv range and which will be equivalent in load capability to overhead lines with summer normal ratings as high as 500,000 kw and higher.

INDUSTRY IN CONFERENCE



Gathered for Annual Meeting of PUAA . . .

Utility Advertising and PR Men Are Told: You've Got to Sell Yourself to Management

Management can and must be "sold" on the increasing needs for and growing importance of solving company and industry problems using the best methods and techniques of modern advertising and public relations.

Speaking for the 39th annual meeting of the Public Utilities Advertising Association, several industry leaders stressed this aim and suggested ways to bring it about.

For example, they used phrases like these:

"Let your management know . . . what will correct their problems . . ." and "It's up to you to convince your chief executives . . ."

EEI's Managing Director, Edwin Vennard, offered this advice:

"Top management cannot be expert in all fields, so do not expect top management to be conversant with the latest survey methods, with the newest approaches to public relations problems without your help. It is your management responsibility to tell your top management team about these things. It is up to you to convince your chief executives of the effectiveness of the available public relations tools and of the needs for using them. It is up to you to sell public relations within your organizations.

"Communications, as a management tool, is even newer than management itself, and its vital role is not yet as completely recognized and understood as it should be. One of your primary problems as members of management is to make sure that communications and the whole complicated area of relations with people are seen in all of their significant dimensions by your top management leaders.

New PUAA President is Frank C. Lietz (at left), of No. Illinois Gas Co., conferring here with Past-Pres. Warren W. Widenhofer, of Indiana & Michigan Elect. Co. PUAA treasurer, re-elected, is Mead Schenck, Interstate Power Co.

"Public relations is the newest field involving management's skill and possibly it is the most nebulous and complex; nevertheless, a great deal of work has been done in theory, in research and in practice—work involving the handling of people. But, methods for dealing with employees, with the public and with people in general are new. As a consequence, we have not de-

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Washington Water Power Co. Tops "Better Copy" Contest Winners

Ninety-four utility companies in the United States, Hawaii, Canada, and Cuba won outstanding honors in the Public Utilities Advertising Association's annual "Better Copy" contest, as announced at PUAA's recent convention in New York.

More than 2,500 entries were received in this year's contest, the 37th annual competition and oldest continuous advertising competition in the world.

The contest included newspaper advertisements, magazines, employe newspapers, direct mail, publications, displays, posters, billboards, annual reports, radio and television, and motion pictures. Most of the entries were divided into three categories according to the size of the utility—up to 150,000 customers, more than 150,000 and less than 400,000 and more than 400,000.

Electric companies were big award winners. The Washington Water Power Company, Spokane, Wash., won five awards. Of six companies which won four awards each, five are electric utilities: Northern States Power Company, Minneapolis, Minn.; Philadelphia Electric Company, Philadelphia, Pa.; Southern California Edison Company, Los Angeles, Calif.; British Columbia Electric Company, Ltd., Vancouver, B. C., and Hawaiian Electric Company, Ltd., Honolulu, Hawaii.

Among firms winning three awards were Commonwealth Edison Company, Chicago, Ill.; and Kansas Power and Light Company, Topeka, Kans.

Others were Otter Tail Power Company, Fergus Falls, Minn.; Pacific Gas and Electric Company, San Francisco, Calif.; Portland General Electric Company, Portland, Ore.; Tampa Electric Company, Tampa, Fla.; and Virginia Electric & Power Co., Richmond, Va.

In addition, 27 companies won two awards each, and 49 utilities each were awarded one certificate.

"Brochure Power," a utility success story, was discussed at the PUAA annual meeting by (l. to r.): G. C. Everett, Jr., Appalachian Power Co.; Jack Spaulding, So. Calif. Gas. Co.; Walter Heren, Union Elect. Co.; and Richard Harmel, LOOK magazine.

veloped as many tools as we have to deal with our engineering problems. Nevertheless, we have many more tools than we seem to be using.

"In the electric utility business, we have developed and have used some valuable tools in correcting the ignorance associated with the devastating ill-will that we experienced during the period of the early thirties and forties. As a consequence, there has been a substantial improvement in the public and employee attitude towards the electric utility business. The last survey showed that some 56-percent of the people have expressed themselves as being in favor of our method of operation. Only 9-percent of the people expressed themselves as being in favor of Federal operation.

"Why don't we inform our customers that they are being served by a company, when so much is involved? That is a management problem. What is it that keeps us from doing this thing? We have the tools. We know how to reach the people. We know how to measure attitude. Why? This is one of the areas which requires a self-analysis and self-appraisal of ourselves as managers."

Mr. Vennard concluded: "I believe that whether or not we Americans remain a free people in a free society depends in large measure on the strength of our economy. In turn, the future of the American economy depends on the ability of business management to make sound decisions based on all available information and using the best available tools. In the vital and increasingly important area of public relations the responsibility for providing management with the information and tools it needs lies with you. The wheel is in your hands. It is up to you to use it."

Advised Ashton B. Collins, Reddy Kilowatt Inc.: "Work the precinct method in your advertising and public relations endeavors. Let your management know what your customers think of your service, rates and bills . . . and tell them what will help correct the problems . . . "

Mr. Collins noted that key statements of industry leaders over the years have formed "a somewhat continuous pattern of frustration based on what might be termed the public's lack of understanding or appreciation of the electric industry." He added:

"Those problems remain and face us; and the continuing growth of the industry keeps those problems dangling ahead of us. Meantime, the promotional arms of the industry are expected to play a greater role.

"Your advertising and public relations boat has been hemmed in by these four walls:

1. Increasing service bills
2. Composition of complicated rate schedules
3. Taxes
4. Political competition

What to do?

"You are going to have to convince your managements that your advertising and public relations boat is important enough to get whatever it takes to break through these technical barriers so that you can get the ship of state out where it can sail the oceans of customers and bring back the precious cargoes of public relations!"

Mr. Collins observed that one of the most constructive things that the PUAA has done in recent years, has been to arrange, at its regional meetings, panels of utility company

LOOK Award winners—for exceptional service to the home-building industry—received award plaques at the PUAA meeting. Representatives of the winning companies (l. to r.) are: G. C. Everett, Jr., Walter Heren and Jack Spaulding—all of whom participated in a panel discussion of "Brochure Power" (see photo above). LOOK's Richard Harmel (at right) made presentations.

customers. This experience has been so valuable, he said, that similar panels should be held in our various regions regularly, and that individual utility companies might also conduct similar clinics, more or less regularly.

Discussing "The Payoff in Corporate Image Research," Horace J. DePodwin of the General Electric Co. related these "clear-cut" conclusions indicated by extensive cooperative research conducted by a few major corporations:

"Just as the corporate image is a delineation of a total company at any one point in time, so, too, is the process of building the image a total company effort. The total actions of a company on all fronts provide the substance of the image, and public communication about such actions determine the shape of the image. While a company's reputation will seldom exceed what its actions merit, the reputation will be somewhat less than what is deserved unless adequate communication interprets in meaningful terms what is being done."

"In the utility business, we are already very close to the line between appropriate government regulation and outright government control of the private utility industry," noted Mr. DePodwin.

"I suggest that we reassess our role in society—that we remind ourselves that each of our businesses stands in a shadow—that this shadow is the mass stereotype of business we have been discussing, as well as the full range of public and employee attitudes toward your individual companies and toward private business and industry as a whole.

"We would be well advised, therefore, to devote more of our time and attention to this crucial matter of our attitudinal environment. We would be well-advised to find greater reserves of knowledge, courage and forthrightness in our communication efforts, and thus influence public attitudes more constructively. And, finally, while much remains to be done in the area of more significant research, we have in the Corporate Image Research concept an extremely valuable tool which merits your attention and support."

Al Gilbert, general sales manager of the Idaho Power Co., listed

Top officials responsible for the NELPA Business Development Section's 35th annual conference held in Yakima, Wash. recently included (l. to r.): Utah P. & L. Co.'s Olin Ririe (NELPA vice-pres.); Pacific P. & L. Co.'s Vice-Pres. A. W. Trimble; Section Chairman R. F. Plymire, vice-pres. of Puget Sound P. & L. Co.; and Pacific P. & L. Co.'s Yakima manager, Jack Kelly, who was chairman of arrangements for the conference.

Promotion-Minded Utilities of the Northwest

Tell Ways to "Sell All-Electric *All*ways" In NELPA Business Development Meeting

"Sell All-Electric *All*ways" was the theme of the 35th annual conference for NELPA's Business Development Section . . . and few if any aspects of selling escaped the scrutiny of busy conferees in the three-day meeting in Yakima, Washington. From their enthusiastic sessions it could certainly be concluded that, while business in the Northeast is good, more of it can be developed . . . and will be!

Several panel discussions designed especially for supervisory and management personnel climaxed the conference proceedings. In these, organization and operating costs of the sales staff were particularly prominent. Chairman of these sessions was Darcie White of Utah P. & L. Co.

"How Much Should Sales Departments Spend Per Dollar of Increased Revenue" was the subject discussed by one panel, headed by Gordon DeFoe of the Washington Power Co. and including: R. F. Plymire, A. S. Gilbert, O. J. Horrom, C. W. Brissenden, D. H. Olney, Bruce Heywood and Mr. White.

As in other areas of utility operation, this panel found it difficult to make specific comparisons between sales procedures of the various utility companies. However, panel responses to questions like these undoubtedly stimulated considerable thought among conferees: (1) How much can advertising take credit for sales increases? (2) How much of our annual sales revenue can be attributed to sales effort? (3) How much should the sales department spend per dollar of gross revenue? (4) Should we spend money and time on marketing studies?

In the Northwest, noted WWP Co.'s D. H. Olney, "all of us have to increase our summer loads . . . and a greater percent of this revenue can be expected to wind up in net income." Discussing the importance of dealer relations, GE's Bruce Heywood advised utilities to "work at supporting an active dealer organization," but warned that it is not promising to devise plans to spend money for this purpose, "unless the dealer organization is strong of itself."

A report on "Results of Recent Space Heating Tests," presented at the NELPA Meeting by Duane Olney and H. U. Wright, both of WWPCo. (seated) is of considerable interest to (standing) Idaho Power Co.'s general sales manager, Al Gilbert, and NELPA's executive manager, Al Krieg.

A panel moderator, B. C. Electric's Otto Zwanzig (left) checks up on program details with Utah P. & L. Co.'s Darcie White, who presided at a program for management and supervisory personnel on which WWPCo.'s Gordon DeFoe was a speaker. Mr. White is the new NELPA Section chairman.

these as the most important objectives of a general sales organization: (1) increased kwh consumption; (2) increased company revenue; (3) the introduction of new products and service uses; and (4) better service to all customers. In his presentation he was assisted by members of his Idaho Power Co. sales staff: Messrs. Reed, O'Connor and Goertzen.

Another management panel discussion, under Moderator Otto Zwanzig, general sales manager of the B. C. Electric Co., attempted to answer the question: Should peak load business be priced to reflect the cost of that business . . . and are peak loads a deterrent to sales? PGE's Leo Chaffin advised: we must provide service in ways customers desire it . . . and our concern for sales and deterrents to sales must be related to this. He also noted that cost-to-serve studies should be considered as only an indication of where to place sales emphasis. B. C. Electric's R. G. Scott said that one object of utility effort should be to encourage customers to use demand meters. Leo Aaltonen of Puget Power listed two important considerations as hours of use and diversity of requirements among customers.

"An Approach to Sales Department Organization" was described by Howard Arnett, vice-president of PGE.

Sales incentives and sales effort evaluation were the subjects of the opening general session of the NELPA meeting. John Mead, vice-president of the So. Cal. Edison Co., reported that his company had developed a "residential sales effectiveness rating" believed to be a better measure for sales accomplishment than the quota system. This device automatically adjusts for and is based on variations for opportunities for sales that may exist in each territory, he indicated.

Clifford E. Hall, of Stone & Webster Service Corp. offered the contradictory observations that (a) *no* sales incentives really work, and (b) *any* sales incentive really works. Because sales incentives are nothing more than tools, he said, what produces extraordinary results for one company frequently falls flat for another . . . and the big difference, when the results are counted, seems to be in the people who handled the tools.

"Only accurate and realistic measurement of your results can tell you whether *your* sales incentive is really working for *you*. And when you are able to measure your results so that you can be certain they add up to Success, you'll find management much more ready to listen sympathetically to your budget request," suggested Mr. Hall.

Electric Heating Interest High

Considerable interest was exhibited in a report, by H. V. Wright and Duane Olney of WWP Co., on a coordinated test program set up to determine electric heating patterns in the Northwest, as well as their effects on system loads. They concluded, from the study of 50 home installations on five utility systems, that the electric space heating load is "at least no worse than the average residential load."

A coordinated test program was set up in this attempt to determine electric heating patterns in the Northwest. NELPA members agreed to meter simultaneously at least ten primary heat single family dwellings, selected at random to represent a cross-section of the electric heat load. Since it was desirable to observe load characteristics during peak conditions, the period from January 5 to February 5, 1960, was selected. Metering on each home included kwh and continuous charted demands on the total load as well as on the heating load.

Among the most significant revelations in the study results are these: (a) As heating use goes up, costs go down; (b) The percentage of electric heating on peak does not necessarily increase as the temperature goes lower; and (c) There is no parallel between this percentage (of electric heating on peak) and temperature drop . . . and, in fact, the amount of peak attributed to heating was considerably less at system peak than at many warmer days at the same hour.

The test period covered system peaks and coldest recorded weather in nearly all areas. In one case the system peak fell ahead of the test period by one day. Usable data was obtained from a total of 50 homes, and although some of the test periods began later than the January 5 date, the desired results were obtained. Two companies furnished 12 homes each, two furnished ten homes each and one furnished six.

Tell Electric Heat Assets

Another panel discussion on electric heating, "Obstacles in Selling Electric Heat" turned to an emphasis of *advantages*, with many of these cited by members in the audience as well as by Panelists G. L. McDonald, J. W. Mowrey, W. P. Riordan and R. J. O'Connor. Mr. O'Connor urged continued concentration on the big market represented by new home builders, recommending not only attention to the custom builder ("he is easier to sell on electric heating"), but to the speculative builder . . . "for we haven't got to him yet."

Other NELPA sessions met the competition head on in discussions titled: "Methods of Competing with Other Fuels" (H. B. Batchelder, Cy Lear, H. U. Wright and Paul Jensen) and "Is Gas Our Real Competitor?" (W. Lowe, C. P. Kommers, Wesley Dunn and C. A. Manson). Said Mr. Kommers: "Against this 'enemy' (gas) we aren't doing so well collectively . . . yet, our real competition is from other industries. Nevertheless, if you don't have gas competition, you are lucky!"

List Conclusions from NELPA Electric Heat Study

According to Messrs. Olney and Wright, several general conclusions may be expressed from the study:

1. Though the system peaks all occurred a few days apart, they were not at all simultaneous.
2. In only one case did the system peak fall on the coldest day of the test period.
3. Of the total connected load an average of only 36-percent of it was ever on at any one time in each home.
4. An average of 69.5-percent of the installed heating was the most that was used at any one time in each home.
5. An average of only 22-percent of the total connected load was on system peak.
6. A certain portion of the maximum total demand recorded in each home was non-heating. The non-heating demand during system peak was 52-percent of the average of these.
7. The maximum heating demands for each home were averaged. The heating demand on system peak was 62-percent of this average.
8. Of the connected heating only 39.2-percent was on at system peak.
9. Of total demands on system peak 65.5-percent was heating.

An analysis of data from one company showed this load factor information:

Total load—3680 annual kwh per kw on peak, or 42-percent L.F.

Non-heating—3480 annual kwh per kw on peak, or 39.7-percent L.F.

Heating—3780 annual kwh per kw on peak, or 43.2-percent L.F.

Sales representatives of the NELPA member utility companies agreed in a conference panel discussion that the space heating market is big, and that the many advantages of electric heating need to be emphasized to overcome "obstacles to selling" which do exist.

Mr. Manson, of the B. C. Electric Co., observed that in the Northwest natural gas is moving in on selective fuel markets previously occupied—"in no small part by default"—by electricity. "So we have a clash, in a narrow field, but nevertheless a clash between natural gas and electricity." Offering "some facts of life as they look to a Gas company," Mr. Manson stated:

"In spite of all we may do, we are generally left with large summer valleys in our annual load patterns. To minimize the effect of these valleys on gas purchase costs, we must build year-round base-load revenue . . . but there are only a limited number of things you can do with gas. So, we must make a dead set for those uses that are open to us, such as cooking and water heating. Because these are year-round loads, our unit gas purchase costs are low, they improve our load factor, they offer us the largest margin of gross profit . . . so they are especially attractive to us."

Other NELPA speakers, gathered informally here are (l. to r.): B. C. Electric's W. A. Lowe, Montana Power Co.'s C. P. Kommers, WWPCo.'s Harold Anderson and Pacific Power's Bjorn Gadeholt.

HT 50 YEARS OF PUBLIC SERVI

Idaho Power's R. J. O'Connor, Cliff Hall of Stone & Webster Serv. Corp., and Robt. E. Holmes, supervisor of GE's Lighting Institute—all speakers on the NELPA conference program compare notes above.

How to Promote Repair Service

Discussing "How Far Can A Utility Go in Providing or Promoting First Class Repair Service," Wm. Creech of Westinghouse advised: "Don't subsidize it; if you have it, use it to back up dealer repair services . . . and get the highest price in town!" He added: "Remember that the most important objective is to make friends of your customers . . . and our surveys indicate that your customers are willing to pay *well* for *good* service."

Pursuing this subject, a panel (C. E. Filbin, D. L. Holt, O. J. Horrom and W. S. Farsje) revealed significant research statistics. For example, Pacific Power's Filbin noted that the average customer spends $42.50 a year for appliance servicing, and 74-percent of this utility's customers consider the service costs charged to be "reasonable." He concluded that, among the 20-percent of dissatisfied customers, we might do something about 15-percent of them.

Reporting on "The Promotion of Residential Lighting," GE's Robert Holmes indicated that the "residential lighting business is holding its own—at a standstill—but this is still pretty good business." He noted that, of the NELPA member companies, only B. C. Electric in participating in the Academy of Lighting Arts program of GE, and he urged others to utilize these facilities in developing well-trained local industry for handling the residential lighting activity.

The NELPA rate research committee heard Pacific Power's Bjorn Gadeholt report on the test replacement of "graphic" industrial load metering with Fischer-Porter devices. After the test with 300 rented units, large customers find that enough is saved in more accurate billing to pay for permanent installations.

Air-Conditioning—Cooperation Asked

Joe Heffernan, advertising and sales promotion manager of GE's air-conditioning division, extended this promise to the NELPA groups:

"You and your customers will hear a great deal from us, starting in January, about the air they breathe and the air of satisfaction that only year-round air conditioning can give. We will sell discontent—discontent with a stale, stagnant, impure, hot humid air. We want you to join us. Your big expansion in the 60's will result from mass acceptance of electric heating and year-round air-conditioning. You didn't hesitate with electric cooking, with whole house lighting, with refrigerators, vacuum cleaners, dishwashers—and they all add up to only a fraction of the kilowatt-hours used by a year-round air-conditioning system.

"Air-conditioning is the one great feature that has not yet been exploited by the builders but the one which he is now rapidly using regardless of his geographical location. Once you and we convince him that people want, need and insist on air-conditioning when buying a new home," asserted Mr. Heffernan, "there is no product in your promotional history that appeals to more of the basic buying motives and satisfies more of the basic desires of the American public than year-round air-conditioning. It offers first of all, health and protection to entire families. It offers the homeowner a sound investment because it does and will increase the resale value of the home itself.

The GE representative noted that the builder can install air-conditioning for about 60-percent of the cost of air-conditioning in an existing home, simply by planning for it. In the average new home, this allows the builder to save the homeowner $500-$800 "real value that will sell homes." Meanwhile, the cost to the builder is "insignificant"—as little as 3-percent of his selling price, according to Mr. Heffernan.

He called on the NELPA group for cooperation in selling this air-conditioning market, proposing this program:

There are three ways in which you can help us—and thereby help yourselves: (1) We have drastically reduced the initial cost of heat pump air conditioning. Installed cost today is one-third of what it was six years ago; yet, operating costs have not been reduced on 75-percent of the meters in the country, and that is a task you and you alone can perform—and let's face it —if you don't, a certain fossil fuel will. (2) You can help us by training your salesmen in air conditioning. (3) You can supplement our promotional program with strong, local programs sponsored by you.

"But," concluded Mr. Heffernan, "the most important contribution you can make is in helping us induce the builders of the country to put year-round air-conditioning in their homes, not as optional equipment, but as part of the mortgage. As for GE, we are embarked this year on the greatest builder-drive in our history—we are going to help builders sell their homes with every conceivable promotional device we know about."

"Poisoned Words"?—Utility Industry Has Some

The terms "public" and "private" are virtually meaningless in representing the electric utility industry's image for the general public, Charles Parker, president of Central Surveys, Inc. told a meeting of the advertising and public relations committee of the NELPA business development section.

In a panel discussion of "Poisoned Words Utilities Use about Themselves," moderated by WWP's Harold Anderson, Mr. Parker advised that opinion research results suggest that "investor-owned" has the most favorable connotation of all terms being used to identify non-government power organizations. "Business-managed," taxpaying" and "shareholder-owned" are all better than "private." To describe government power, "federalized" has the most accurate connotation, he noted.

Mr. Parker, responding to a question, said that a few utilities have considered changes in corporate names to rid themselves of the word "public". He suggested recognition of big kwh users, possibly through such a simple approach as a letter acknowledging their status equivalent to "100,000-mile airline customers" . . . and telling them about the bargain they are getting in electricity.

Many, Not Few Factors Determine Street-Light Cost

Optimum cost of maintaining and operating street lights cannot be reached by endeavor in one direction only. Each of the following items have some effect on cost of a street-light system: cutouts, sockets, lamps, chains, voltage, current, reporting, washing, group replacement, mounting height, supports, vibration, buffers, photoelectric controls, gaskets, manpower efficiency, trucks, lightning arrestors, painting, grounding, and others. Such cost factors were vigorously attacked at the annual Street-Light Conference, sponsored by the Mitchell Maintenance Co., May 18-20 in Muncie, Indiana.

Complete objectivity was fostered by "no-holds-barred" discussion ground rules which were set up between Mitchell's utility clients, street-light manufacturers and Mitchell executives. Benefits of such a discussion were stressed by President R. G. Duncan, Executive Vice-President J. C. Strasbourger, and Vice-President, Sales and Design, M. E. Mitchell, in their opening remarks.

Get Realistic Costs

According to Lawrence C. Renas, manager Dayton Electric Operations, Dayton Power and Light, the following is a realistic basis for arriving at true maintenance and operation costs: Out-of-pocket costs consist of labor, transportation and material. "These costs are easily calculated from hourly rates, time and material invoices. Other costs include interest, taxes, fringe benefits, tools, apportioned supervision, etc." While these costs would vary slightly from company and area, "An average easily-applied formula would be material costs plus 12 percent added to transportation plus 15 percent and bare labor plus 35 percent," he said.

Lamp Tells A Story

The lamp, itself, received much attention during discussion. Color of an incandescent lamp is a good indicator of proper system operation, said Messrs. Thomas H. Woeste and G. K. Harrington, both of Mitchell.

After an incandescent lamp is on the system for a while, its light-brown color indicates proper current conditions; a light-light brown shows too little current; while a dark brown indicates too much current flowing. Lamp color detects air leakage, too. A fast leaker will show up white or yellow while a slow leaker will exhibit a characteristic blue color.

Still a bit puzzling is a problem with 2500-lumen series lamps which have a small-diameter section in the stem called a built-in cutout. Investigation of excessive failures revealed that with a medium (2 ma leakage current) external cutout, when a surge occurs in the circuit, the built-in cutout flashes over, an arc forms in the filament-head wires, and cuts off the filament support. Once this happens, apparently a chain reaction starts, and more than one of the bulbs can blow in the same circuit. However, in 40,000 cases, when the low cutouts (35 ma leakage current) were used in place of the medium type, the situation was rectified. One advantage of the close-leaved construction, however, is that it does protect the lamp socket.

Throughout the conference the Mitchell people stressed the importance of observation during maintenance operations. "Make a visual inspection of your lamp. If the filament is intact, you know the light was burning," they said. In a storm area, take apart every 15th or 20th cutout encountered and check with your knife, they advised. Primary and lightning faults both have an effect on cutouts down the line. But, "If you can pull three good cutouts in a row, the rest should be good," they said.

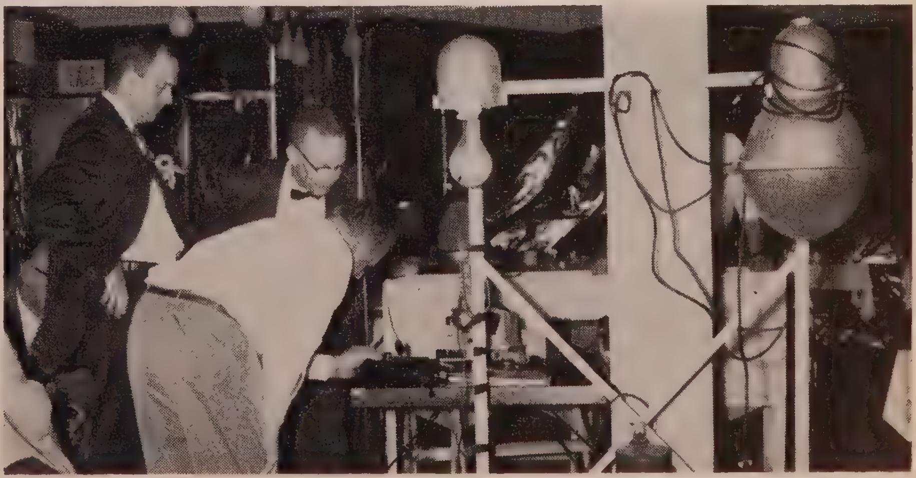
Stress Good Reporting

Proper reporting of observations in the field is a major step toward optimum operating and maintenance. Said Mr. Mitchell, "With proper reports, you'll know what's wrong."

"Your street-light service man is the basic cog in the whole system," stressed Frank N. Wones, Dayton Power and Light, and, added Mr. Renas, "Enlisting the aid of the local police department in reporting all street-light outages found during their nightly patrols is a valuable asset to good operation." The police, as well as the serviceman, are furnished with DP&L's standard street-lighting report sheet. Light outages are reported by the light number and direction from a street intersection and by street side.

DP&L's reporting system has public relations advantages, too. After a complaint has been received and service restored, the complaining customer is notified by phone. However, no night repairing is done except in highly special cases.

By judicious scheduling and study, DP&L brought its street-light maintenance cost per dollar of capital investment to a point below



A 37 percent light loss from an unwashed lens compared to a washed lens was demonstrated during the conference. This condition can happen in six months on some systems—earlier on others. Tom Woeste of Mitchell Maintenance adjusts current flow in series lamp on rack. Russell Dahl of Joslyn (left) and A. A. Young, West Penn Power double check current readings.

that of its distribution system maintenance cost.

A help to maintenance crews is the company's color-coding system on the lamp itself. Different colored inks are used for each different six-months replacement plan. Thus, lamps are quickly identifiable. Ink is applied with a dispenser similar to those used on weather-report programs on TV.

Thermal Shock

While higher mounting heights took care of yesteryear's high breakage of street-light glass due to vandalism, today's big safety hazard and high replacement cost bugaboo comes from glass breakage due to thermal shock. "A perfect example of thermal shock can occur when cool rain strikes a hot fixture glass," commented H. A. Van Dusen, Jr., Line Material Industries.

Results of a L-M sponsored research project on thermal shock included the following:

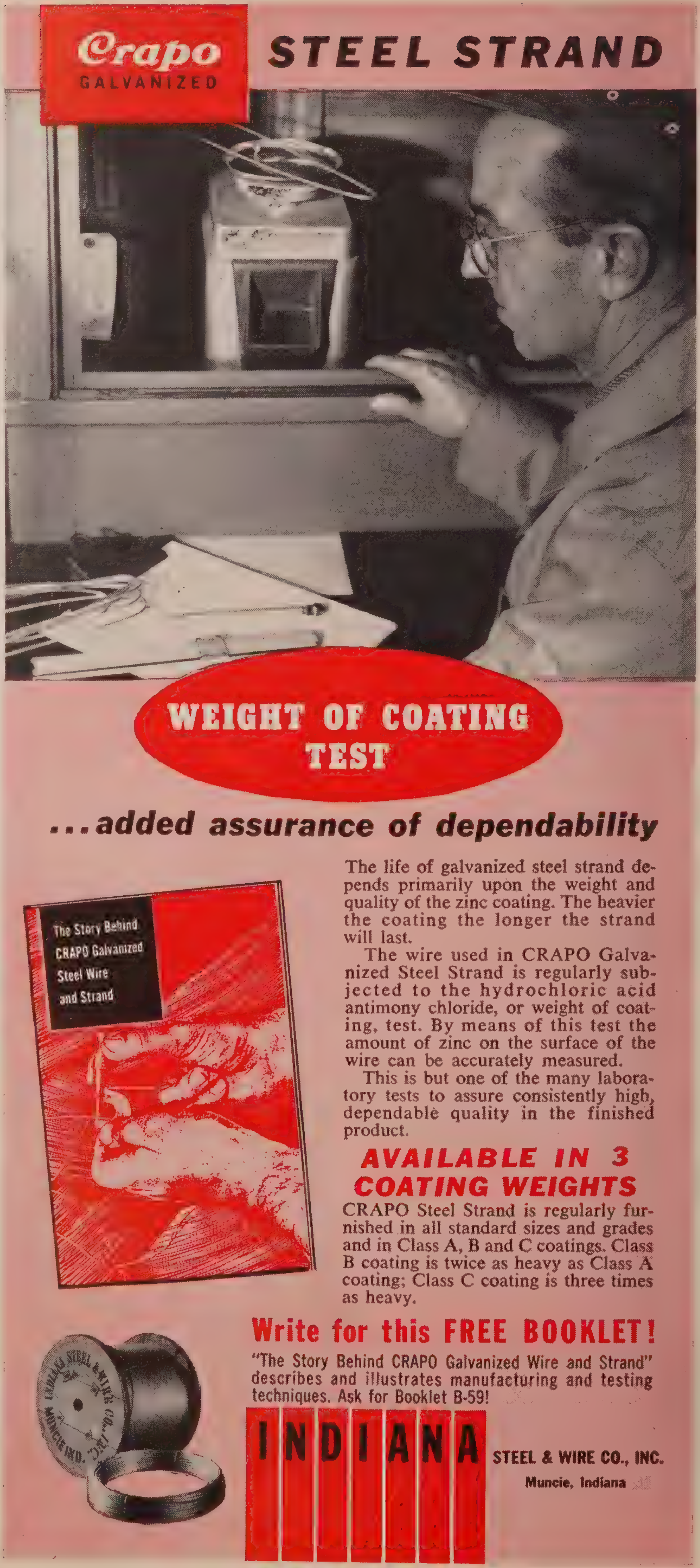
1. Thermal shock parameters include luminaire temperature, lamp type, and amount of dirt on the glass ware, and luminaire design.
2. Thermal shock damage can be easily identified because of its different characteristics from impact damage. Impact gives chipping, while thermal shock breaks are clean and have a propagation pattern similar to that of waves formed by a pebble dropped in a calm pond of water.

It was generally agreed that maintenance and breakage are related. If there is a breakage problem, maintenance of the glass in clean condition can help.

E. B. Karnes of Westinghouse Electric Corp. suggested careful handling because a break can be started by bumping the glass and may not manifest itself until later.

John Young, consulting engineer, discussed differences between the various types of streetlights. He seconded David Toenjes' (General Electric Co.) remark that there is no advantage in visibility of one color over another. Present thinking is: equal footcandles between lamps for equal visibility.

In Mr. Young's experience on lamp depreciation, he has found that the incandescent has the best score on maintenance.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INDIANA STEEL & WIRE CO., INC.
Muncie, Indiana

I-T-E Research Supports Use of Liquid-Cooled Bus

Liquid cooling can provide extremely important gains in economy and space-savings for currents of 10,000 amperes and over, and for runs of 200 ft and above, according to I-T-E Circuit Breaker Co.

These findings are the result of extensive testing in the high voltage laboratory at I-T-E's Greenburg division, where both water and oil were tested as coolants in sections of high-current, isolated phase bus used as generator-to-transformer leads.

A test facility to prove the practicality of liquid cooling was established last year, using 22-ft runs of three-phase bus designed to carry 10,000 amps at 23 kv. Both water and oil were used in separate tests to obtain thermal, hydraulic, and electrical design data.

Power was supplied to the test by a special laboratory three-phase thermal transformer. Individual phase currents were regulated by induction voltage regulators and measured by meters connected to current transformers mounted on the transformer secondary. Thermocouples measured temperature rise at various points.

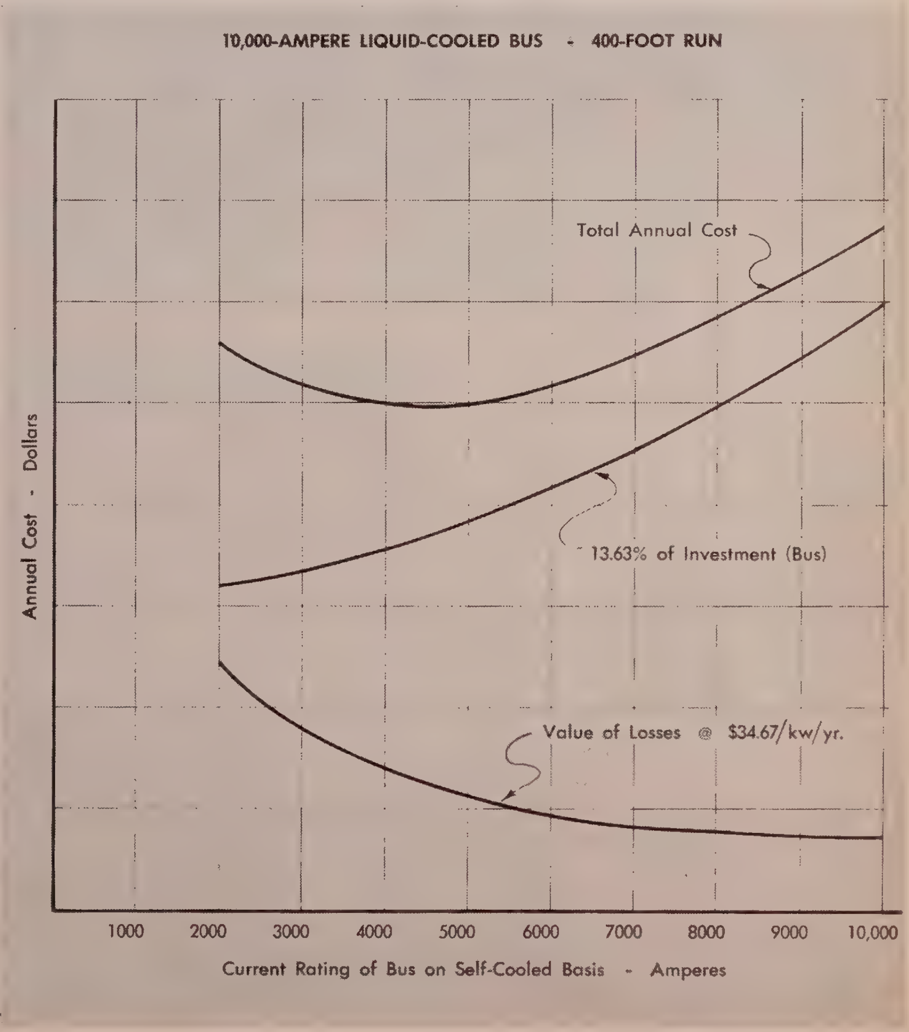
Test runs using oil as the coolant were completed in March, 1959. Extremely successful, the project demonstrated the significant practical possibilities, economies and merits of liquid coolant through a distance of as much as 1000 ft of conductor without removal of the coolant for additional cooling.

The tests also indicated that significant amounts of overload capacity could be provided by investing in relatively inexpensive auxiliaries. Total electrical energy input to all auxiliaries should be small—on the order of one to three percent of conductor losses for the optimum size conductor selected.

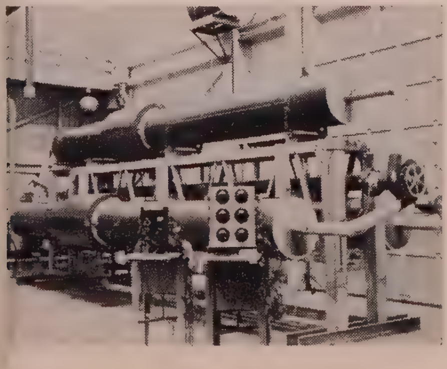
Water was used as a coolant in a second series of tests completed last fall. Ordinary tap water was used with an ion exchanger to obtain the necessary purity for the experiment.

The tests proved that the extra thermal capacity of water can be used to advantage in reducing the cost of large bus structures.

Cost comparison shows total annual cost as a combination of amortization charge for capital investment in bus and cooling system, and cost of losses from buses ranging from 2000 through 10,000 amperes. Hypothetical case here shows costs for 10,000 ampere bus on a 400-foot run from power station generator to transformer. Optimum size bus appears between 4000 and 5000 amperes for self-cooled size when used with liquid cooling.



Liquid cooling of 22-foot sections of isolated phase bus in three-phase arrangement is tested in high-voltage laboratory at I-T-E's Greensburg division. Significant gains — lower operating costs, savings in space—were indicated for bus runs carrying over 10,000 amperes for distances of 200 feet or more. No additional cooling required even for runs as long as 1000 feet.



Solid-State Remote Control Equipment Announced

Unattended automatic control of utility generating systems is just one of a number of jobs performed by an electronic supervisory control system announced by General Electric Co.

Brains of the new solid-state supervisory equipment are hundreds of tie-pin size transistors and diodes, performing the job of mechanical switches and making possible relatively trouble-free and maintenance-free performance of any job calling for remote metering, monitoring or control. The equipment may be used with any two-way communication channel, including low-cost telegraph-grade leased wire.

Transistorized logic elements, the thinking elements of the equipment, direct and receive operation messages to and from remote apparatus through a master station-remote station system. These elements are plug-in cards, with no moving parts.

Using GE's proved space-code, the master station sends signals to remote stations in the form of pulses and pauses with operating intelligence carried by the pauses. Each control point has its own code which cannot be mistaken by the equipment for another code. A point on the master station consists of a grouping of indicating lamps and a key to initiate selection. The lamps indicate the code has been established between the master station and the remote station; when an action has been initiated and completed; and an alarm for each specific point.

Engineered to be functionally compatible with conventional systems relay-type, solid-state equipment can be mated as a master unit with existing relay-type remote units, or added as additional remote stations in an all-relay system. With floor space requirements reduced by as much as 50 percent and no increase in height over conventional units, installation of the new supervisory equipment is much simpler. Weight reductions of up to 25 percent also add to its versatility.

Control voltage for the logic elements is provided by a 12-volt self-contained battery.

Federal Pacific Tests Equipment Finishes

Determination of a new surface finish for outdoor equipment, one that will withstand all types of weather—heat, cold, humidity, sand storm, chemical contamination, and salt spray—is no small problem to a manufacturer.

This problem was faced seven months ago by transformer development engineers of the Federal Pacific Electric Co. They set out to determine the most suitable finishing coat for a new line of outdoor transformers the company was developing.

Federal Pacific hoped to find out three things from the study:

First, the best way to prepare the surface of aluminum for application of a plastic insulation and various surface finishing materials?

Second, the necessity or non-necessity of applying finish coating on aluminum that has been anodized, irridited, and treated with the plastic insulation?

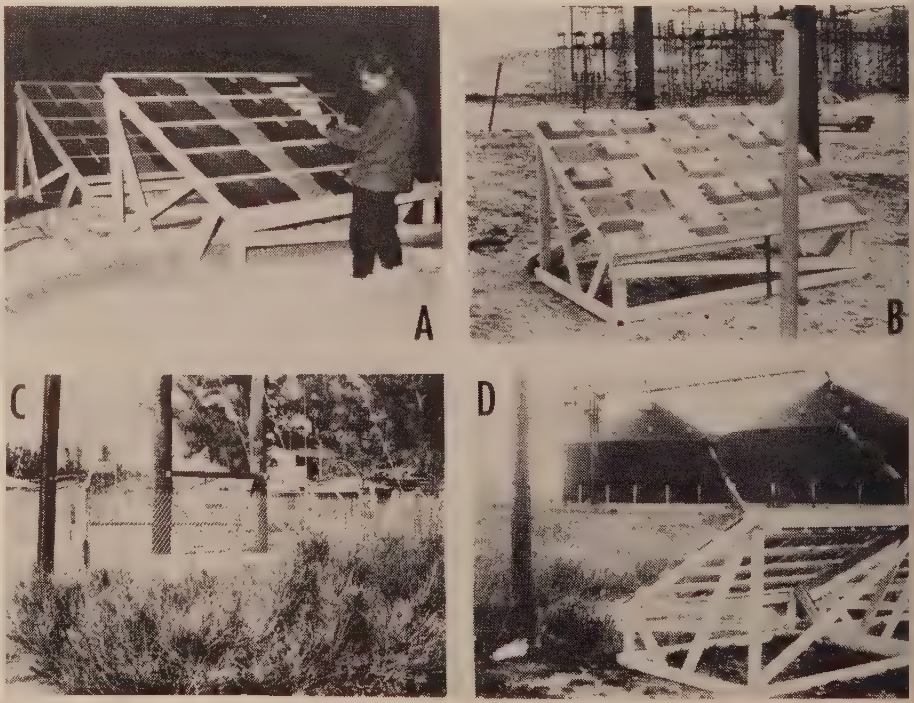
Third, the general weathering characteristics of the several different finishing systems under investigation?

Federal Pacific felt that standard laboratory simulation of weather conditions would not produce data as accurate as they needed. To obtain valid data, the company sent an engineer from Florida to Alaska to set up a network of testing sites where weather exposure experiments could be made under actual climatic conditions.

Six sites were finally settled on as providing a complete range of adverse atmospheric conditions. These areas were: Fairbanks, Alaska, for cold and snow; Mohave Desert, Calif., for sand storm; Corpus Christi, Texas, for chemical contamination, salt spray, and heat; St. Petersburg, Florida, for high humidity and heat; Moss Landing, California, for seashore conditions of smog and humidity, and Newark, New Jersey, for industrial contamination.

In each of these areas, a total of 70 one-foot-squares of aluminum—representing ten samples of each of seven different types of finishes—was exposed to the atmosphere on specially-built structures. According to the plan, a sample from each of the sets will be brought to the company's Newark headquarters every six months for a study of its decomposition.

Four of the six Federal Pacific test sites are shown, chosen to aid F-P engineers determine the best possible coating to withstand all severe climate conditions.



Control and Interlocking . . .

(Continued from page 49)

trips, to prevent the combustion control system from lowering fuel gas pressure below a safe minimum. A careful study of the fuel burning characteristics of each burner system should be made to determine whether the above is necessary.

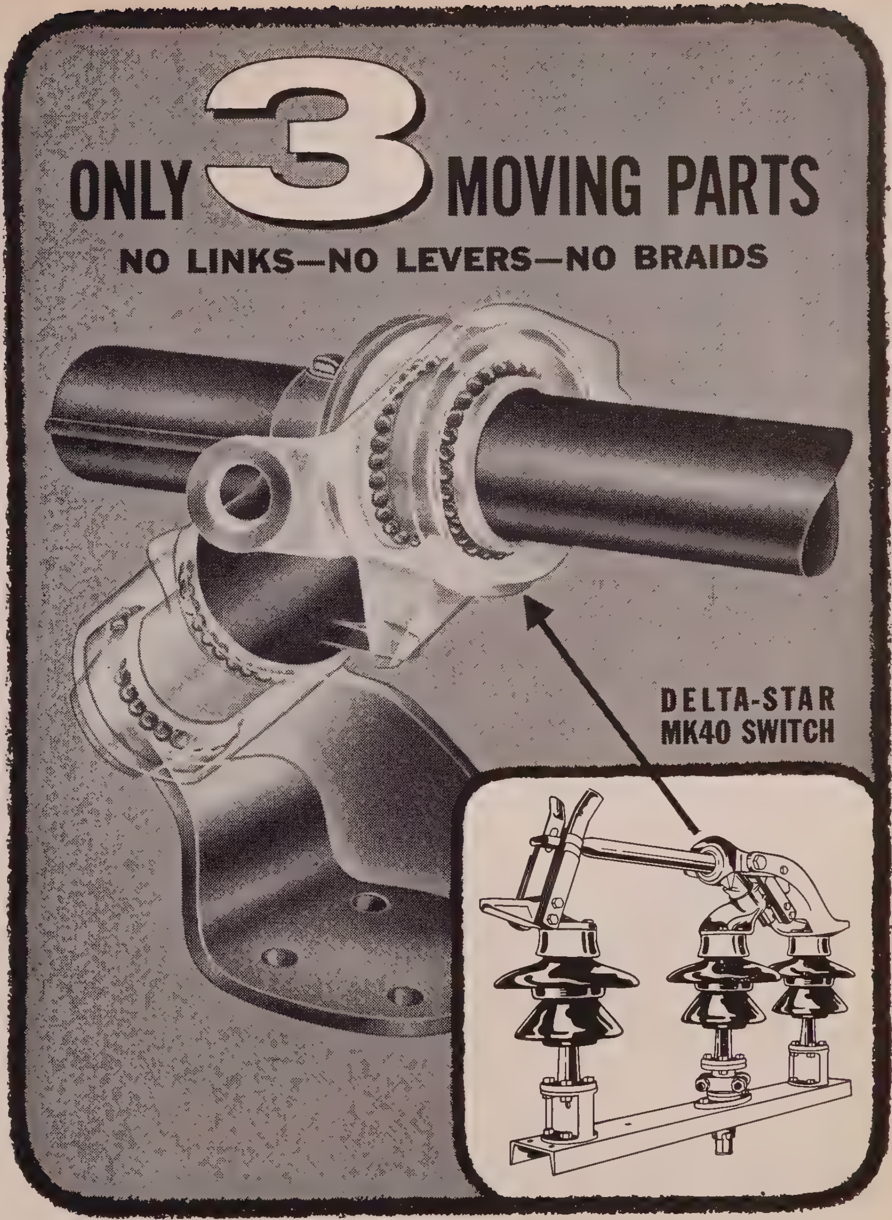
Conclusions

It is quite obvious that there is a strong trend toward more automation in control and operation of modern generating stations, coupled with a consequent reduction in the number of operating personnel. As each major change occurs, it requires that a close and detailed study be made of protective interlocking and control schemes in order to assure that these schemes are consistent with the new operating policy.

As more and more plant operations are taken out of the operator's hands and are made automatic it places a higher degree of reliance on quality components. Although components have been a major source of trouble in the past there is a very definite and gratifying trend toward improvement of components noticeable at the present time. The trend toward the use of static state components, and application of continuous self-checking circuitry are steps in the right direction.

Design and application of these advanced control schemes will require a much closer co-operation between mechanical and electrical engineers. It will force a better understanding of each other's basic problems and a better working knowledge of the characteristics, limitations, and weaknesses of the tools and equipment available in each other's field. It is already becoming difficult to designate a great many control problems as either "electrical" or "mechanical" in nature.

Finally, schemes of interlocking and control that are presented herein are all in controversial areas. It is hoped that more papers on this subject will be forthcoming, and that they will stimulate enough discussion and constructive criticism to lead to better understanding of the problems.



The simplified switch driving mechanism of the Delta-Star "MK-40" Switch has only three moving parts. Links, levers, and braids, which are sources of trouble both in operation and maintenance, have been eliminated.

Trouble-free operation in the worst weather is assured by the "MK-40's" powerful leverage. The blade is twisted about its axis in the first 15° of rotation, relieving contact pressure. The 45° adapter gives a high mechanical advantage when it is most needed—23° of insulator rotation provides the first 10° of blade lift. Blade is under positive control during both opening and closing cycles, and locks in both open and closed positions. Factory sealed bearings require no lubrication—simplifying maintenance.

"MK-40" Switches are available in capacities from 400 to 4000 amperes—7.5 to 400 KV. For complete information, write to *Delta-Star Electric Division, H. K. Porter Company, Inc., 2437 Fulton St., Chicago 12, Ill.*

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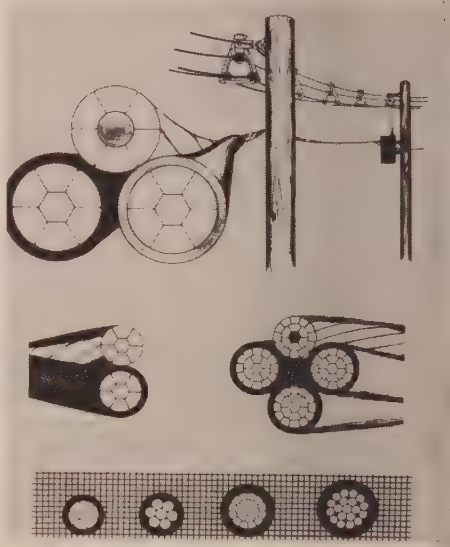
NEW PRODUCT DESIGN

Color-Coded Cable Offers Positive Phase Identification

A marriage of "Hypalon" synthetic rubber insulation and "Compresto" aluminum conductor in two improved types of conductors is announced by **Olin Mathieson Chemical Corp.** "Hypalon" is claimed to give exceptional wear and weather resistance, permits color coding and positive phase identification in secondary networks, shown (upper drawing) in conjunction with spaced aerial cable installation. Available in black, electrical red and electrical grey, cable is also used in duplex (left center) and quadruplex (right center) constructions. "Compresto" conductors have smaller diameter, reduced weight because of elimination of interstices between strands (bottom drawing). "Hypalon" is made by **E. I. du Pont de Nemours & Co., Inc.** The cable is made by **Southern Electrical Co.,** conductor manufacturing unit of Olin-Mathieson's Metals Division. Cables are rated as a 600-v triplex.



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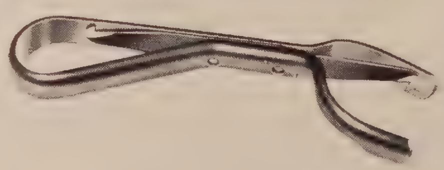

Cable Sheath Slitter

Especially good for most outdoor, heavy-duty types of cable sheathing, a Cable Sheath Stripper by **P. K. Neuses, Inc.,** handles large and small diameter cables equally well. The hook blade digs in between sheathing and wire and with the aid of side supports permits most accurate jacket stripping. Can hook into cable at any point without previous notching. Unit includes extra blade.

Circle item #20 on reply card

Strain Insulators

Hubbard and Co. has offered a line of strain insulators made of fiber glass. Light in weight and impervious to decay, the insulators are moisture-proof and exceptionally durable. No arcing horns are necessary. Units are tested to 30,000 lb tension before shipment. According to the manufacturer, the insulators have glass-like surfaces which are self cleaning. Special lengths and accessories are available.

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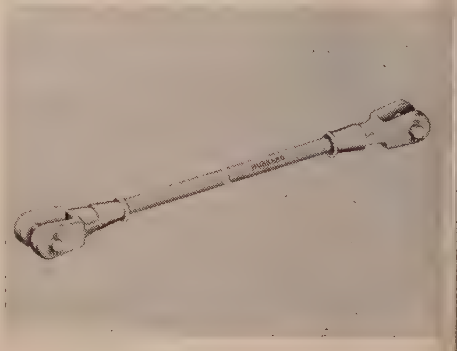

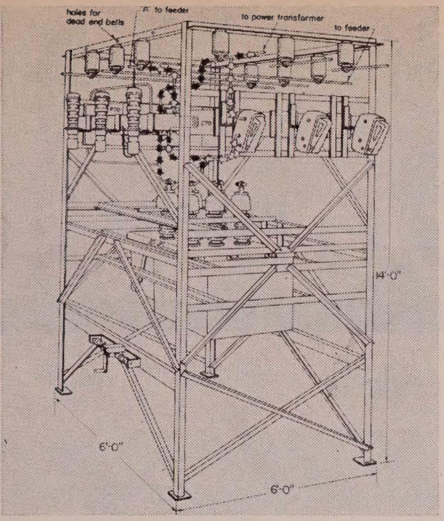

Recloser Bypass

A complete package recloser bypass structure for the low-voltage side of a 15-kv distribution substation has been developed by **Westinghouse.** Includes a PR recloser with drawout contacts for disconnecting, bypass devices, lightning arresters and provisions for instrument transformers. It can serve as a dead-end structure for outgoing feeders since it is capable of 4000-lb loading. Structural members are aluminum.

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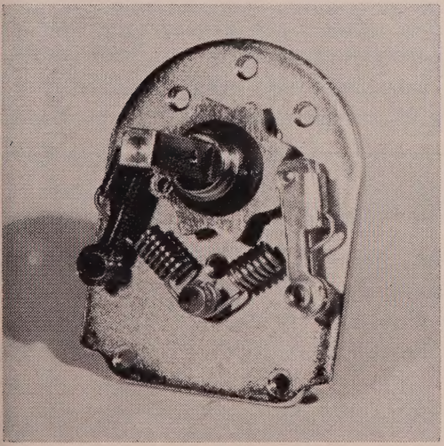

Instrument Control Switches

Allis-Chalmers has recently redesigned its line of Type 210 instrument and control switches to incorporate a positive positioning feature. Guarantees reduced arcing and burning of contacts by preventing the possibility of "hang up" between positions. Overshooting is virtually eliminated. Positioning wheel and roller are case hardened for maximum life. Switches are also corrosion resistant.

Circle item #23 on reply card

Powerhouse Motors

Westinghouse has introduced a new line of powerhouse Life-Line® A motors from 40 to 250 hp in frames 364U through 506US. Furnished in three basic NEMA designs: A and B (normal torque) for pumps, fans, compressors, etc.; C (high breakaway torque) for driving compressors without unloaders, loaded conveyors, etc.; and D (for high accelerating duty or high inertial loads) for car dumpers, hoists, etc.

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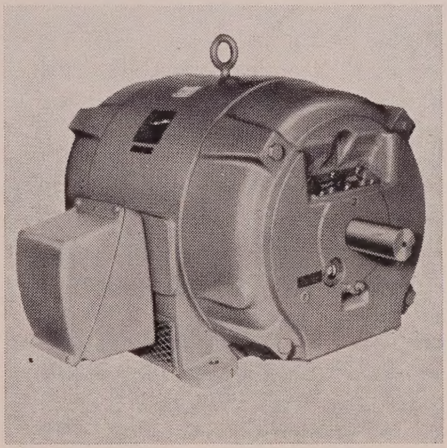

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Major savings in pole replacement costs are possible with a planned inspection and treating program using Chapman POL-NU. This superior grease-type preservative containing a full 10% pentachlorophenol restores natural losses of the original preservative in the critical ground-line area to add years of life to standing poles.

Pol-Nu Bandage-Maker slashes ground-line treatment costs

Maximum economy and effectiveness in the application of ground-line treatments are achieved with the Pol-Nu Bandage-Maker. This portable device prepares, as needed in the field, ground-line preservative bandages.

Improved Pol-Nu Pak

For those who prefer a factory-sealed, ready-to-use pole bandage, the Pol-Nu Pak offers real advantages. May be applied instantly by maintenance crews, is easy to stock and handle.

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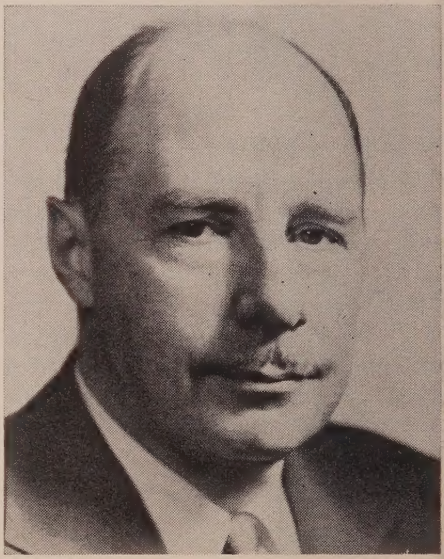
MEN OF POWER

Forrest Promoted To Vice President

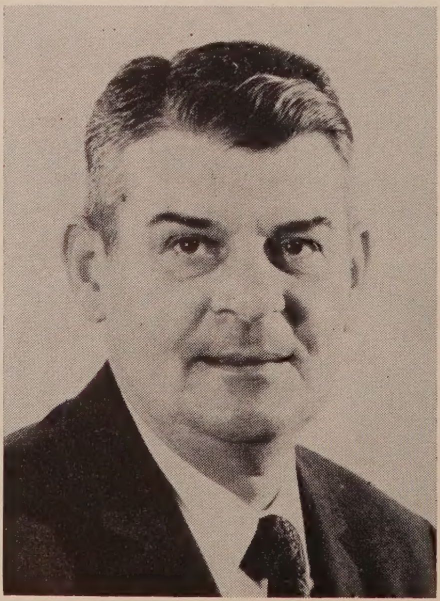


Melbourne A. Forrest has been named a vice president by Burns and Roe, Inc., New York City engineers and constructors. He will continue being responsible for the company's operations in power, nuclear, and industrial facilities, in addition to defense and aeronautical projects.

With Burns and Roe since 1947, Mr. Forrest has held a number of important posts. He was assistant to the company's executive vice president from 1950 to 1955, director of the executive engineering division from 1956 to 1959, and last year was named director of the power and industrial facilities division.

Prior to joining Burns and Roe, Mr. Forrest was with Consolidated Edison Company of New York as district engineer in the distribution engineering bureau. He designed systems supplying the Empire State and Chrysler Buildings, Radio City, and others. He also planned distribution systems for heavily concentrated business areas in Manhattan and other sections of New York.

Oleksiak New V. P. Of United Engineers



Walter F. Oleksiak, 25-year veteran in the heavy construction field, has been elected to the newly created post of vice president - construction of United Engineers & Constructors Inc.

Mr. Oleksiak has been with United Engineers since 1941 when he joined the firm as a field engineer. Since then he has held various construction posts including that of construction manager to which he was named in 1958.

At United Engineers, he has had extensive experience in construction of power stations, steel mills, and chemical, pharmaceutical and processing plants.

Before joining United Engineers, Mr. Oleksiak had been a field engineer and project engineer with several firms engaged in construction of bridges, commercial buildings and institutional facilities.

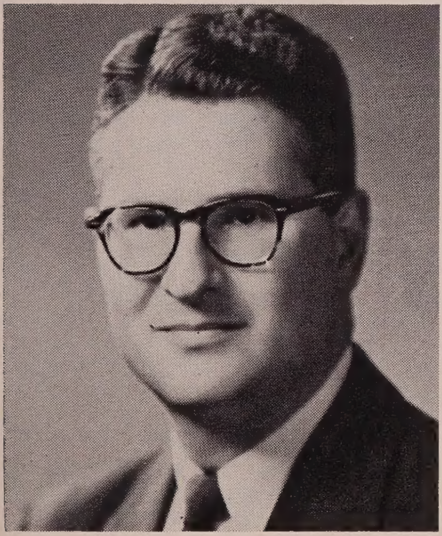
RG&E Elects Two New Vice Presidents

Harold S. Weatherby has been elected vice president and comptroller of the Rochester Gas and Electric Corp. and Paul W. Briggs has been named secretary of the company. Announcement was made by Robert E. Ginna, chairman of the board.

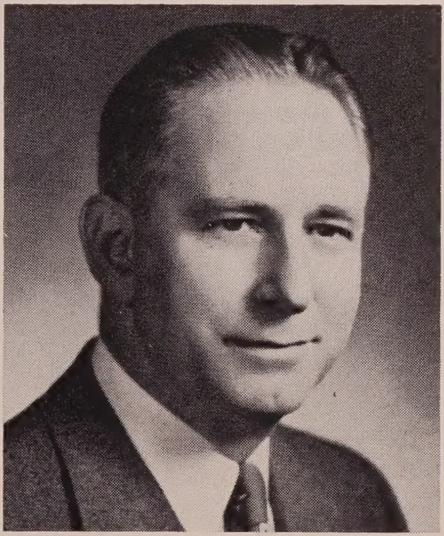
Mr. Weatherby was formerly secretary and comptroller of the company. He was elected to that post in 1957. Previous to that he had been assistant secretary and superintendent of general accounting. He joined the company in 1927.

Paul Briggs started with RG&E in 1945, as a clerk. After several promotions he became assistant secretary of the company in 1957.

Briggs



Weatherby



MEN OF POWER BRIEFS

Walter E. Selkinghaus, now superintendent of Carolina Power and Light's Darlington City plant, has been named superintendent of the atomic power plant being built at Parr, S. C., by Carolinas Virginia Nuclear Power Associates.

Duquesne Light has appointed **R. R. Murdock** assistant to the chairman and to the president.

Southeastern Electric Exchange has appointed **Robert W. McKinnon** assistant director. Mr. McKinnon is succeeded as executive secretary of the Public Utilities Association of the Virginias by **Donald M. Jones.**

Chief United States delegate to the International Electrotechnical Commission (IEC) meeting in Paris last month was **John R. Linders,** general supervisor for relay engineering, Cleveland Electric Illuminating Co.

Henry F. Naybert, Northern States Power, has been elected chairman of the accounting section of the Wisconsin Utilities Association. **Robert C. Horn,** Wisconsin Public Service Corp. was named vice-chairman.

Recently elected assistant vice presidents of Rochester Gas and Electric Corp. were: **George H. Fiedler,** general superintendent of electric and steam divisions; **Frederick J. Pfluke,** general superintendent of gas division; **Francis E. Drake, Jr.,** manager-rate and economic research department; and **Schuyler F. Baldwin,** director of public relations.

J. W. Gaines, former assistant northern division manager, has been named manager of the division.

Virginia Electric and Power Co. has named **Richard W. Carroll** director-residential and rural sales, and **William R. Black** sales supervisor at Alexandria.

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CALENDAR OF EVENTS

July 24-August 5—Columbia University, Ninth Annual Utility Management Workshop, Arden House, Harriman Campus, Harriman, N. Y.

August 9-12—American Institute of Electrical Engineers, Pacific General Meeting, El Cortez Hotel, San Diego, Calif.

September 7-9—Northwest Electric Light and Power Association, Annual Convention, Glacier Park Lodge, Glacier National Park, Mont.

September 7-9 — American Society of Mechanical Engineers, Joint Automatic Control Conference, Massachusetts Institute of Technology, Cambridge, Mass.

September 15-16—American Society of Mechanical Engineers, Engineering Management Conference, Morrison Hotel, Chicago, Ill.

September 21-23—Inter-Industry Farm Electric Utilization Council, National Electric Farm Power Conference, Hotel Louisville, Louisville, Ky.

September 26-30—Instrument Society of America, Fall Instrument-Automation Conference and 15th Annual Meeting, New York Coliseum, New York, N. Y.

September 28-30—Indiana Electric Association, 51st Annual Convention, French Lick-Sheraton Hotel, French Lick, Ind.

September 29-30—Electric Companies Public Information Program, 1960 PIP Workshop Conference, Sheraton-Charles Hotel, New Orleans, La.

September 29-30—Southeastern Electric Exchange, Accounting Conference, Tides Hotel, St. Petersburg, Fla.

October 5-7—Wisconsin Utilities Association, Electric and Gas Sales and Operating Sections Convention, Schroeder Hotel, Milwaukee, Wisc.

October 6-7—Electric Council of New England, Transmission and Distribution Committee Meeting, Lake Morey Inn, Fairlee, Vt.

October 9-14—American Institute of Electrical Engineers, Fall General Meeting, Morrison Hotel, Chicago, Ill.

October 20-22—Electric Companies Public Information Program, Second National Youth Conference on the Atom, Musuem of Science and Industry, Chicago, Ill.

November 9-11—American Institute of Electrical Engineers, Second Power Industry Computer Application Conference, Chase Hotel, St. Louis, Mo.

November 16-18—Southeastern Electric Exchange, Sales Conference, Henry Grady Hotel, Atlanta, Ga.

December 1-2—Institute of Radio Engineers, 11th National Conference, Professional Group on Vehicular Communications, Sheraton Hotel, Philadelphia, Pa.

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